ROADMASTERS' CONVENTION NUMBER

# Railway Maintenance Engineer

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RAILWAY MAINTENANCE ENGINEER
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# Exhibitors' Section

## Eleventh Annual Exhibit

of the

# Track Supply Association

Held in Connection With the

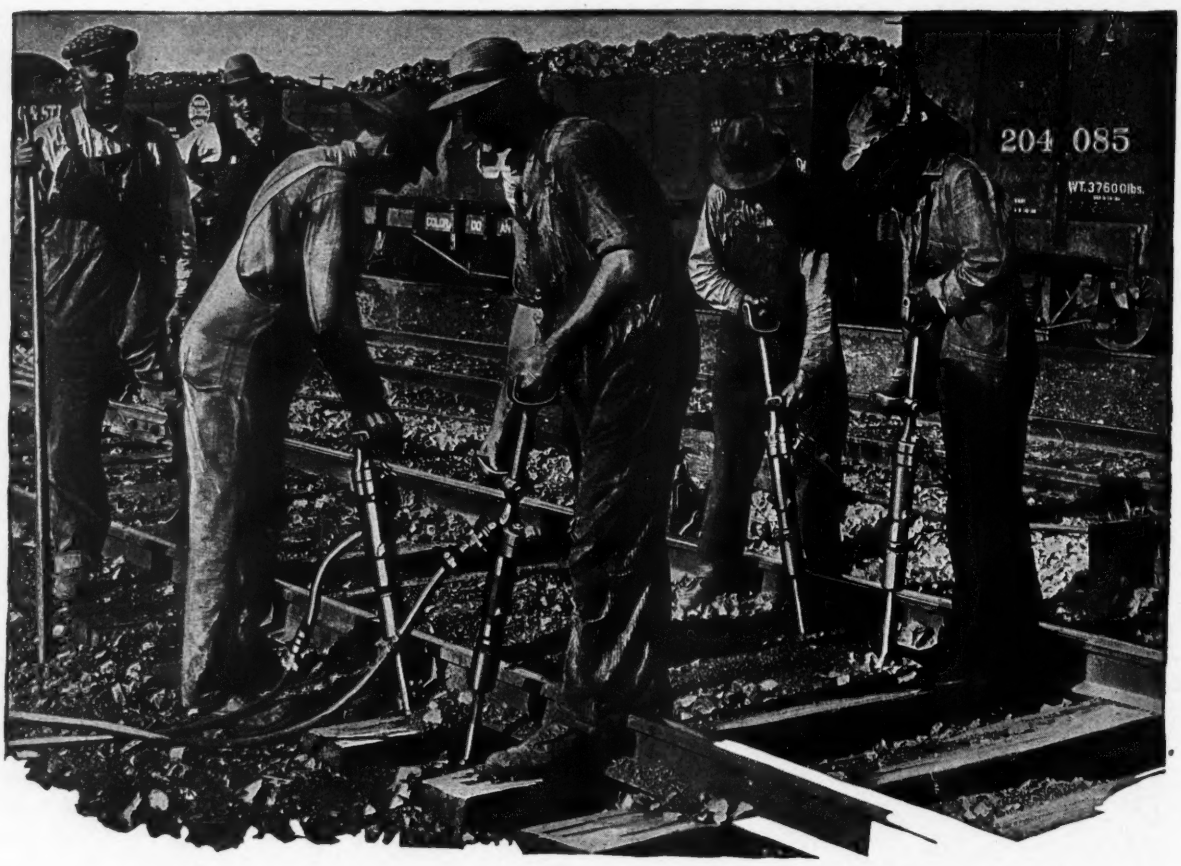
## 40th Anniversary Meeting

of the

## Roadmasters' and Maintenance of Way Association of America

**In this special section are grouped descriptive pages on railway track supplies and maintenance of way equipment and material exhibited at Cleveland during the Convention, November 21-23.**

EXHIBITORS REPRESENTED IN THIS SECTION

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Our exhibit at the Roadmasters' Convention, Hotel Statler, Cleveland, will be at Booth 18, November 21, 22, 23. Drop in for a few minutes—we want to see all our old friends and hope to meet many new ones. The exhibit will interest you and you will find the time well spent.

To those who cannot avail themselves of this invitation, we wish to extend cordial greetings and best wishes for the coming year.

Many of you have seen Atlas "A" service in successful operation during this last season, for an increasing number of roads have recognized Atlas "A" advantages. We confidently believe that next year will see many more added to the list of satisfied users.

If we are unable to talk to you personally at the convention—let us send you our literature, or if you desire, our representative will call at your convenience.

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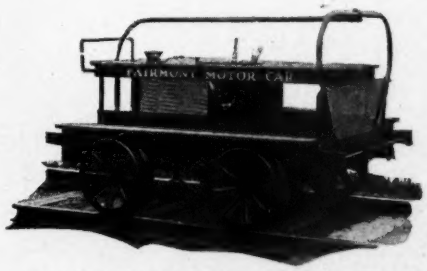


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## Visit With Us at the Show

The 40th annual Roadmasters' and Maintenance of Way Convention, Cleveland, Ohio, November 21st—22nd—23rd. Hotel Statler. FAIRMONT exhibit in booths Nos. 61 and 62.

Come in to our quarters and make yourself at home. We want to meet you and talk railroading with you. We will have some interesting things to show you. If you do not attend the convention write us for information on the new Fairmont models—you will be interested in them.

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Track protected by HIPOWER is like a sound long time investment with interest paid in continuous security of track at reduced cost of labor and expense.

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# Railway Maintenance Engineer

Vol. 18 December, 1922 Number 12


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### WOULD YOU LIKE TO KNOW

The effect of proportioning on the strength of concrete?
How to build an inexpensive timber lift bridge?
If the track should be given a general lift when ties are renewed?
Where the section gang should leave off and the extra gang begin?
The consensus of opinion regarding the spacing of joint ties?

Answers to these and other practical questions will be found elsewhere in this issue.




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WE GUARANTEE, that of this issue 9,050 copies were printed; that 7,265 of these copies were mailed to regular paid subscribers, 53 were mailed to advertisers, 31 were mailed to employees and correspondents, and 1,701 were provided for new subscriptions, samples, copies lost in the mail and office use; that the total copies printed this year to date were 88,950, an average of 7,413 copies a month.

*Railway Maintenance Engineer is a member of the Associated Business Papers (A. B. P.) and of the Audit Bureau of Circulation (A. B. C.)*

# Zero Maintenance

IF, let us say, heat treated bolts save 25% of tightening costs—

And a special splice bar saves 25% more—

And rail joint springs save another 50%—

You can call in your track gangs and your bolt tightening cost is zero.

YOU see the fallacy. That is why we hesitate to speak in definite percentages. But figure your saving this way:

As a matter of fact, bolts do become loose. Whether it is due to stretch or mechanical wear is immaterial. When nutlocks are used, stretch or wear of 1/64th of an inch demands immediate attention. Stretch or wear of 1/32nd of an inch means dangerous looseness.

With rail joint springs, however, after stretch or wear of 1/16th of an inch, you still have a tight joint, with the spring exerting six times the reactive pressure of a nutlock that is fully compressed.

Now do your own arithmetic.

**VERONA TOOL WORKS, Pittsburgh, New York, Chicago**

Railway Maintenance Engineer

**The Construction of Highway Crossings**

It has been estimated that there are approximately 250,000 highway grade crossings in the United States. The maintenance of these crossings devolves on the railways and constitutes no small item of expense. Until recently they have been constructed almost universally of plank, but with the depletion of the better grades of timber, with the corresponding increase in price and the necessity for more frequent renewals brought about by the use of inferior woods, the cost of maintenance has risen rapidly. At the same time, the service to which these crossings are subjected has become more severe and the growth of automobile travel has necessitated a higher standard of maintenance. These conditions have served to bring other forms of construction to the front. Concrete is being used to a limited extent experimentally, while greater progress is being made with bituminous macadam construction, several forms of which are now available. This construction has much to commend it and it is meeting with much favor in many quarters.

**The Art of Leadership**

There are many things which cannot be taught in a correspondence course, including such subjects as courting a girl and handling a gang of hobos. While leadership, as displayed by the pile driver foreman at a washout or the chairman at a directors' meeting, is only in part a matter of native ability, it is something that cannot be learned from books. In the series of interviews with railway executives which has constituted a regular feature of the *Railway Maintenance Engineer* for the past year, the predominating thought has been to emphasize those elements of personal effectiveness that are essentially apart from the quality of leadership. Industry and knowledge have been urged rather than the ability to cause others to follow one's directions. While the last element of success is in many ways intangible, it is influenced by certain factors that are capable of analysis and this has been done with most remarkable force and clearness in the paper by S. E. Shoup on "The Essentials of Morale." This is worthy of study by anyone who directs the work of others.

**The Standardization of Lumber**

How thick is a one-inch board? The inability to give a definite answer to this question is one of the reasons for the efforts now being made to standardize practices in the lumber industry. The movement was started through the agency of the United States Department of Commerce under the leadership of Herbert Hoover, who has pointed to the wastes that arise from the diversity of practices prevailing in this and other industries. As an illustration of the conditions in the case of lumber, it has been pointed out that in one large city alone one-inch lumber is sold in a half-dozen different thicknesses. But the question of sizes is only one of the problems involved. Other subjects to be taken under consideration include grades, designation of species, classification of defects, etc. The efforts to obtain standardization are being taken up by a voluntary organization in the lumber industry representing the manufacturers, wholesalers and retailers. The Department of Commerce is a party to this movement only in so far as it can be of assistance to the representatives of the industry in carrying out the work. The project is still in the preliminary stage and for the present covers plans for determining the prevailing conditions, the preparation of tentative suggestions for modifying or improving present practices and a thorough exchange of opinion in regard to all changes offered. This development is of vital interest to the railroads because of the large amount of lumber that is used by them.

**Co-operation Through Education**

The problem of securing co-operation between employees of different departments of an organization increases as the size of the organization grows. This is illustrated by the experience of the track and signal forces on most roads. The men are working for the same company; their work contributes to the common purpose of transporting freight and passengers. On the small road where the lines of organization center in a single man close to the work little differences may be ironed out quickly, the division of duties altered readily to fit local conditions, and the men work with a spirit of give and take. As the organization grows in size, however, and the authority is concentrated in persons further removed from the gangs, the departmental spirit is naturally intensified and the local co-operation tends to disappear. While this is a natural result of a large organization, it is not a necessary result. As pointed out by Mr. Peabody in his paper before the Roadmasters Association, this difficulty arises in large measure from the degree of specialization inherent in railway work which leads to a lack of understanding of the problems of the other man. This points to the necessity of developing means of educating each man concerning the more important problems of the men in other departments with whom he comes in contact.

**Why Not a 39-Foot Rail?**

Not many years ago 28 ft. was the standard length of rails. Some time later it was superseded by 30 ft., and more recently it has been increased to 33 ft. The limit in each instance has been fixed primarily by the length of the cars available for transportation. This length has now increased to 40 ft. It is therefore reasonable to inquire why the length of rails cannot now be increased to 39 ft. The advantages of such a step are numerous. In the first place, each joint is an added source of expense, both in first cost and in maintenance, and any reduction in the number required will effect a marked saving. Furthermore, the joint is the weakest part of the track structure and any measures which will reduce the number will add to the strength of the track as a whole and contribute to smoothness of riding. In past years when rail was unloaded and laid largely by hand, the added weight of longer rails was a factor to be considered, but with the increasing use of heavier sections mechanical equipment has come into such general use that this increased weight is no longer a serious consideration. The

principal objection comes from the manufacturers, some of whom would find it necessary to make certain changes in their mills before they could roll rails 39 ft. long, although two mills owned by different companies, one in the east and another in the west, are now equipped to roll rails of this length and others should arrange to do so if the needs of their customers are best served by this step. Now that cars are available for delivery of rails of this length the roads should be able to secure them whenever they insist upon getting them.

## THE TREND TOWARDS HEAVIER RAIL

SOMEWHAT over ten years ago there was a general movement towards the use of heavier rails and the 75-lb. and 80-lb. sections were largely replaced with those weighing 90-lb. per yard on important main lines. In only a few instances were rails of 100-lb. or heavier sections adopted at that time. Beginning three or four years ago the same tendency again appeared and has been gaining momentum since that time. Starting with the adoption of a 136-lb. rail by the Lehigh Valley and a 130-lb. rail by the Pennsylvania, this tendency has continued until other roads, including the Baltimore & Ohio and Great Northern, adopted sections as heavy as 130-lb. for the first time last year. Within recent weeks the Southern Pacific has announced that it has adopted a 110-lb. section for main line use and several other roads have heavy sections under consideration for 1923 rolling. This drift towards heavier rail is a result of the growing realization of the fact that the weight of the rail has not kept pace with that of the loads it is called upon to carry and that the increasing difficulties in maintaining the rail are indications of distress. It is to be expected that a heavier rail will reduce the cost of maintenance because of its increased stiffness and ability to distribute the loads more widely over the roadbed. However, the economies are not confined to this. In his discussion of the report of the Rail Committee before the convention of the American Railway Engineering Association last March, W. C. Cushing stated that as a result of the Pennsylvania's experience with 130-lb. rail it has been estimated that it outlasts the 100-lb. section two and one-half times. Also, contrary to early reports, he stated that the failures of 130-lb. rails were much fewer than those of 100-lb. section, notwithstanding the fact that the heavy rails were placed at the points of most severe traffic. These advantages are in addition to a reduction in the cost of maintenance of 23 per cent on districts of heavy curvature. The experience of the Pennsylvania and other pioneers in the use of these heavier sections is exerting an important influence on other roads which are considering the adoption of the same measures. The tendency toward the use of heavier rails is to be commended in line with the increasing demands which are being made upon the track structure.

### THEIR RIGHTS

**Winter is at hand. Improvement work has been completed or suspended for the season. The problem for the next three months will be to keep in operation that which has been built. This period is a test of men. It is even more a test of organization—of the thoroughness with which unusual demands have been anticipated. With the outlook for a traffic heavier than ever before at this season of the year, every delay, however slight, will add to the already over-burdened roads. Relief lies in planning for all possible emergencies, even to the most remote details. Minutes spent in precautions now will save hours in the cold and storms of the weeks to come. It is not too late to make another check of plans, whether they cover a section, a division or a system.**

**There is much of the heroic in railroading, particularly in the winter when the maintenance forces must brave the elements in order that trains may move without interruption. In the mountains, and it is here that winter is found at its worst, it is not uncommon for men of long service to insist on transfer to the most severe points at the approach of cold weather, maintaining that such points are no place for a tenderfoot. If such is the spirit where the mountains are, let a spirit comparable to it be manifested where the conditions are less severe.**

## KNOWING THE COST MAY HELP

WHILE maintenance officers may differ as to the best ways of obtaining economy in their departments, there is no dispute about its importance in this or any other branch of railway service. Its importance as a factor in maintenance has been particularly appreciated since the war. Many of the appropriations have been so meager and the regulations affecting maintenance work have been so stringent that officers have found it next to impossible to accomplish many of the things they set out to do and of necessity would do if it were not for the rigid exercise of economy. As a result a great deal of attention has been devoted to this subject in recent years. The presentation of a report on labor saving devices at the Roadmasters' Convention is an illustration. This action in the direction of economy, it goes without saying, has not taken place without beneficial effect.

It also goes without saying, however, that the opportunities for effecting economy in maintenance are by no means exhausted. As an example, consider the losses that arise each day from the neglect or misuse of equipment and the uneconomical use of time. In water service, for instance, an investigation will often find a pumper so caring for equipment representing an outlay of several thousand dollars that losses arise, which, though unintentional, are comparable to his pay. Again an investigation may find a repair man, however well meaning, displaying an extravagance in ordering equipment or a mismanagement in otherwise conducting his work that entails expenses amounting to very appreciable sums annually. Again instances are plentiful where oil is handled like water, and other supplies, such as coal and chemicals, as though their cost were inconsiderable. As in water service, so instances similar in type are numerous in other branches of maintenance. These losses constitute a real problem for the officers under whose jurisdiction they arise, for the reason that, in many cases the difficulty is not one which can be cured by penalties or by instructions, but rather one which very often arises out of a lack of concern as to the value of the property in their charge and the cost of the work they do.

This fact, however, affords a suggestion that may help in meeting the problem. It is well known that when a man buys for his own consumption he ordinarily measures his purchases by his pocketbook, and that in almost every transaction he is governed by a sense of values. When he buys, he first inquires as to the price and if the purchase costs him considerable he exercises corresponding care in using it. Having exhibited such a habit in his own affairs it seems not unreasonable that, to a degree at

least, this habit would manifest itself in his day's work, if he is as fully aware of the significance of values in this field. It is therefore pertinent to suggest that this sense of values concerning the property they use and the work they do be developed and, by constant attention, kept alive. Advanced, as it is, as a possible means of helping to effect economies in a direction where many economies are yet possible of attainment, it would seem to warrant serious consideration by maintenance of way officers.

## LIGHT COLORED PAINTS AS AN AID TO ILLUMINATION

ILLUMINATION is determined only in part by the intensity of the source of light. This is true whether the light comes from a window or from an electric lamp. One factor in illumination values which is often overlooked is the color treatment of the walls and ceiling. If these are finished in light tints a lamp of low candle power may give better results than a much larger lamp would afford if dark shades of paint had been used. The difference is due to the much greater reflecting power of the light colored walls, a consideration now rather generally recognized in developing the interior illumination of cars.

Recent observation would seem to show that this matter was not always so carefully studied in so far as it concerns railroad buildings. For example, the walls of the toilet room in a small station were found to have been painted a dead black, with the result that the light which came in through the small window was almost completely absorbed and the room was so dark that it was impossible to distinguish an object on the floor.

An indifferent public, unappreciative of the accommodations furnished it by the railroads, is exceedingly careless in its treatment of toilet rooms and nothing seems to encourage or induce untidy habits so directly as darkness. Plenty of light also encourages and facilitates the caretaker in keeping the place in a sanitary condition. Then why not provide conditions that make cleanliness possible?

It is conceded that the problem of maintaining station building walls, particularly those in toilet rooms, is a difficult one because of the propensity of certain miscreants to ornament the walls with anything but appropriate markings. This, no doubt, is the explanation for the black paint, but the result would seem to justify the conclusion that here was a case where the attempted cure was worse than the disease.

## THE RAILWAY'S INTEREST IN MECHANICAL EQUIPMENT

A PROBLEM which confronts every officer when introducing mechanical equipment in engineering and maintenance of way work is that of enlisting the interest of the employees who are to use this equipment. All men are creatures of habit in large measure and are prone to follow those practices to which they have become accustomed. A new type of equipment which changes established measures meets with opposition because of these changes and faces an up-hill fight to secure adoption. Its deficiencies are magnified and it is commonly considered by the men as a competitor rather than an aid. As a result it does not receive the sympathetic consideration which a new device requires and little or no opportunity is afforded for it to demonstrate its economies. While this is a condition which must be reckoned with by the manufacturers of equipment of this character, it is even more a problem of the railways. Economic progress in railway service as well as elsewhere in this country demands increased production from every man and this can be secured only by the more extended use of mechanical aids. The railways are suffering today because of their failure to realize the economies which are possible with the use of such equipment. Rather than assuming a neutral attitude towards it and placing the burden of its development and the demonstration of its economy entirely on the manufacturers, the roads are warranted in co-operating to the fullest extent in making such equipment a success because of the savings which will accrue *to them.* They owe it to themselves to foster the development of every form of equipment of this character and after the equipment is installed past experience has shown the necessity of giving it sufficient supervision to insure that the inertia of the local forces is overcome and that the equipment is employed properly.

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## NEW BOOKS

**Proceedings of American Railway Engineering Association.** 1,370 pages, illustrated. 6¼x9¼ in. Published by the Association, 431 South Dearborn street, Chicago.

This volume contains the proceedings of the twenty-third annual convention held at the Congress hotel, Chicago, on March 14 to 16 inclusive, 1922. It includes the reports of 23 committees with discussions. Among the reports of special importance are those on Warehouses in Connection With L. C. L. Freight Houses; Specifications for Movable Railway Bridges; Ash Pits; Engine Terminal Layouts; Filling Bridge Openings; Methods of Educating Employees in Engineering and Maintenance Work; Standard Plans for Wooden Trestles; the Operation of Trains Against the Current of Traffic on Multiple Track Railways; Specifications for Railway Buildings and the Protection of Marine Piling Against Borers. The volume concludes with the memoirs of John Findley Wallace, first president of the association, and George H. Webb, a director of the association.

**Railroad Construction, Seventh Edition.** By Walter Loring Webb. 4½x6¾ in. 845 pages. Bound in flexible imitation leather. Published by John Wiley & Sons, Inc., New York.

"Webb," as this treatise on railroad construction is popularly called, is too widely known among engineers for the seventh edition to require more of a description than merely to point out those respects in which it differs from the earlier editions—unless, for the information of those not familiar with earlier editions, the statement is made that while in keeping with its title, considerable space is devoted to subjects which are strictly railway construction in character, the treatise by successive editions has become of such general application to the everyday engineering problems that it might more appropriately be entitled "Railway Engineering" than "Railway Construction." In revising the seventh edition as when revising the sixth edition five years previous, the author has been guided almost entirely by the work of the American Raiway Engineering Association. The most outstanding result of this has been the insertion in the new edition of an entirely new chapter on stresses in track in which the author gives a very condensed account of the findings of the association on this subject. In keeping with the trend of developments, the author has also made important changes and additions in the chapters on shrinkage of embankments, on the laws governing the life of ties and developments in substitutes for wood ties, in the chapters on rail and rail wear, on rail joints, on water tanks and on train resistance; and has nearly rewritten the chapter on yards and terminals in conformity with present practice. As usual, the tables constitute a conspicuously important part of the treatises.

*Where Good Concrete Was an Important Factor*

# Promoting the Art of Making Good Concrete*

## Laboratory Studies and Experiments in Practice Show That Proper Proportioning May Double the Strength of the Mixture

By D. A. Tomlinson

**Manager Railways Bureau, Portland Cement Association, Chicago.**

PORTLAND cement, which forms only 15 to 25 per cent of the volume of concrete, is carefully tested to see that it meets exacting specifications. Aggregates, which form 75 to 85 per cent of the volume of concrete, should also be tested. Aggregates should be clean, free from coatings or organic impurities and structurally sound. Furthermore, proper size and grading of aggregates, or proper proportioning of fine and coarse aggregates, may double the strength of concrete, as shown

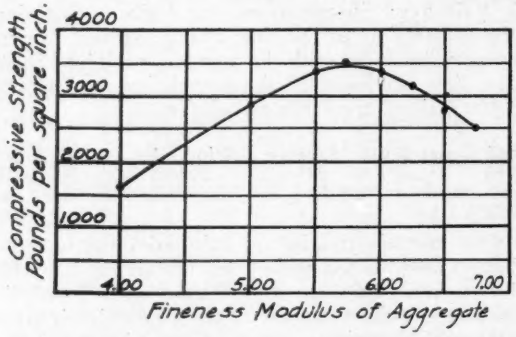



**Figure 1. Relation Between the Grading of the Aggregate and the Strength of Concrete**

in Fig. 1. Doubling the strength as the result of a few hours' study and a little closer supervision is surely worth while.

### Grading of Aggregates Varies

Any number of fine and coarse aggregates of widely different size and grading may meet the usual specifications in those respects. If combined in arbitrary proportions, such as 1:2:4, some of them will make far better concrete than others. For best results a proportion should be determined for each case that will fit the particular aggregates to be used. A little study will quickly show which of two or more available aggregates is the better grade and will therefore make the best concrete. Consideration of these factors may permit the use of local materials, with a saving in freight. It may also result in securing high grade concrete at lower cost. Such studies can readily be made by any competent engineer or inspector, and at very small expense.

Assuming a given consistency, which should always be as stiff as the nature of the work permits, and a given mix (proportion of cement to total aggregate), the strength of the resulting concrete depends on the size and grading of the aggregate. In general, the larger and coarser the aggregate, the stronger will be the concrete. Coarse sand will produce stronger concrete than fine sand, while stone or pebbles in which the larger sizes predominate will produce stronger concrete than smaller stone or pebbles.

### Fineness Modulus Shows Grading

A simple index number, called the "fineness modulus," has been developed to indicate the size and grading of aggregates, and therefore their value for use in concrete. It can be applied to either fine or coarse aggregates, or to any combination of them. It shows at a glance which of two or more aggregates is the better graded. From it the proportions in which given fine and coarse aggregates should be combined are easily computed.

To determine the fineness modulus of an aggregate it is only necessary to make a simple sieve analysis. A set of U. S. standard square mesh sieves is used, each sieve having a clear opening double the width of the next smaller size. These sizes are 100, 50, 30, 16, 8 and 4 meshes per lin. inch, and ⅜-in., ¾-in. and 1½-in. For larger aggregates 3-in. and 6-in. sieves may also be used. The percentage of the aggregate, either by weight or by volume, coarser than each sieve is measured. The sum of these percentages, divided by 100, is called the fineness modulus. A close approximation can be obtained by using only alternate sieve sizes, 50, 16, 4 and ¾, and estimating the percentages for the others. These four sieves make a convenient set for field use.

Table 1 gives the sieve analyses and fineness moduli of ten aggregates. The first is sand, the second, pebbles. The other eight aggregates were formed by combining these materials in various proportions. As the percentage of pebbles increases, the aggregate becomes coarser and the fineness modulus grows larger, thus reflecting the size and grading of the aggregate.

### Good Grading Doubles the Strength

The last column shows the compressive strength of concrete made from those eight aggregates in the proportions of one volume of cement to four volumes of total aggregate. These strengths are plotted in Fig. 1. It will be noticed that up to a certain point, the concrete increases in strength as the aggregate gets coarser. Beyond that point the aggregate is too coarse for the amount

*The second of a series of articles outlining the principles of making good concrete, the first of which appeared in the October issue. Other articles in the series will appear in later issues.

of cement used and the concrete decreases in strength. It will be noticed that proper grading of aggregate may

TABLE 1. SIEVE ANALYSIS AND FINENESS MODULUS OF AGGREGATE

| Ref. No. | Sieve Analysis. Per Cent Coarser Than Each Sieve 100 | 50 | 30 | 16 | 8 | 4 | ⅜ | ¾ | 1½ | Fineness Modulus | Comp. Strength of a 1:4 Mix. Lb. per sq. in. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1... | 99 | 93 | 63 | 40 | 20 | 0 | Sand | .. | .. | 3.15 | .... |
| 2... | .. | Pebbles | | .. | .. | 100 | 75 | 25 | 0 | 7.00 | .... |
| 3... | 99 | 93 | 68 | 55 | 39 | 23 | 17 | 6 | 0 | 4.00 | 1630 |
| 4... | 99 | 95 | 79 | 70 | 59 | 49 | 37 | 12 | 0 | 5.00 | 2910 |
| 5... | 100 | 95 | 84 | 77 | 70 | 62 | 46 | 16 | 0 | 5.50 | 3370 |
| 6... | 100 | 97 | 86 | 79 | 73 | 68 | 51 | 21 | 0 | 5.75 | 3540 |
| 7... | 100 | 98 | 90 | 85 | 79 | 74 | 56 | 18 | 0 | 6.00 | 3390 |
| 8... | 100 | 98 | 91 | 89 | 85 | 81 | 61 | 20 | 0 | 6.25 | 3150 |
| 9... | 100 | 99 | 94 | 93 | 90 | 87 | 65 | 22 | 0 | 6.50 | 2790 |
| 10... | 100 | 100 | 98 | 96 | 94 | 93 | 70 | 24 | 0 | 6.75 | 2540 |

double the strength of the concrete. For other mixes the same principle holds true, although the greatest strength would be obtained with a different grading. The richer the mix, the coarser the aggregate and the larger the fineness modulus that will give the strongest concrete.

Aggregate No. 3, with a fineness modulus of 4.00, corresponds to a bank run gravel; it contains entirely too much fine material for best results. Aggregate No. 10, with a fineness modulus of 6.75, corresponds in grading to a crusher run stone; it contains too much coarse material. This shows the folly of using either bank run gravel or crushed run stone. Such material should always be screened and recombined in proper proportions.

### The Fineness Modulus Is Simple

The fineness modulus of any mixture of two or more aggregates, such as fine and coarse, is merely the weighted average of the fineness moduli of the separate materials. For example, if 32 per cent of sand No. 1 (F. M. = 3.15) is mixed with 68 per cent of pebbles No. 2 (F. M. = 7.00), the fineness modulus of the mixture is:—

$$\text{F. M.} = \frac{32 \times 3.15 + 68 \times 7.00}{100} = 5.77$$

This agrees closely with the value given in the table (5.75) for aggregate No. 6, which was found by a sieve analysis.

Sieve analyses, which are easily made, will give the fineness moduli of any fine and coarse aggregates, while a simple calculation will show the fineness modulus of any mixture of them.

If the proper fineness modulus for the work in hand is known (see below), the proportions in which given fine and coarse aggregates must be combined to secure that fineness modulus can readily be computed.

Sieve analyses of aggregates may vary over a wide range, but as long as the sum of the percentages coarser than each sieve (fineness modulus) is the same, the aggregates may be expected to give uniform results in concrete. This relation is shown in Table 2, which gives the sieve analyses, fineness moduli and concrete strengths of 10 aggregates made up by artificial grading of the same sand and pebbles. Although the sieve analyses vary, the total, or fineness modulus, is the same in all cases. Note that all 10 aggregates made concrete of substantially the same strength, the mean variation from the average being only 6.2 per cent.

Thus the fineness modulus, which is an index of the size and grading, indicates the value of an aggregate for use in concrete. The reason is that, eliminating variations in the absorption of the aggregates, the fineness modulus reflects the quantity of mixing water necessary to obtain a given consistency.† In general, consistency and mix being the same, the fineness modulus indicates the strength that can be expected in the concrete. Other conditions being the same, aggregates having the same fineness modulus will produce concrete of substantially the same strength.

†The water-cement ratio theory of the strength of concrete is fully explained in Bulletin 1 of the Structural Materials Research Laboratory, Lewis Institute, Chicago.

### Proportions Depend On Aggregates

Applying this principle to actual construction, it means that if several fine and coarse aggregates are available, concrete of substantially the same strength can be made from any combination of fine and coarse material, provided that the materials are proportioned to have the same fineness modulus. For one set of materials the proper proportions may be 1:2.3:2.7, for another 1:1.6:3.4 and so on. To apply an arbitrary mixture, such as 1:2:3 to all aggregates, regardless of their grading, will not give uniform or satisfactory results. The mixture should

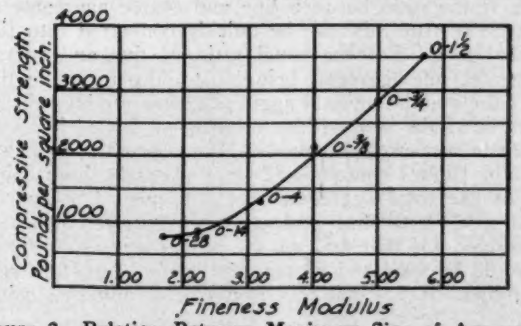



**Figure 2. Relation Between Maximum Size of Aggregate, Fineness Modulus and Strength of Concrete**

be determined after a study of the particular aggregates to be used. If the grading of the aggregate changes during the progress of the work it is an easy matter to change the mixture accordingly.

It is obvious that aggregates having a larger maximum size will have a larger fineness modulus. This is shown in Fig. 2, where it will be noticed that as the maximum size increases, the fineness modulus increases, and also that the strength of concrete increases.

TABLE 2. STRENGTH OF CONCRETE FROM AGGREGATES OF UNIFORM FINENESS MODULUS

*Mix 1:4 by volume. Relative consistency 1.10. Age at test 28 days. Specimens (6 by 12-inch cylinders) were stored in damp sand and tested damp.*

| Ref. No. | Sieve Analysis. Per Cent Coarser Than Each Sieve 100 | 50 | 30 | 16 | 8 | 4 | ⅜ | ¾ | 1½ | Fineness Modulus | Comp. Strength Lb. per sq. in. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 11... | 95 | 89 | 82 | 75 | 67 | 67 | 67 | 62 | 0 | 6.04 | 2780 |
| 12... | 98 | 95 | 90 | 83 | 83 | 83 | 50 | 22 | 0 | 6.04 | 2530 |
| 13... | 98 | 94 | 90 | 86 | 83 | 80 | 55 | 18 | 0 | 6.04 | 2590 |
| 14... | 96 | 90 | 80 | 80 | 80 | 80 | 60 | 38 | 0 | 6.04 | 2570 |
| 15... | 90 | 85 | 81 | 78 | 75 | 73 | 66 | 56 | 0 | 6.04 | 2580 |
| 16... | 100 | 93 | 82 | 73 | 73 | 73 | 63 | 47 | 0 | 6.04 | 2880 |
| 17... | 100 | 100 | 100 | 92 | 81 | 60 | 45 | 26 | 0 | 6.04 | 2930 |
| 18... | 100 | 99 | 96 | 91 | 80 | 50 | 50 | 38 | 0 | 6.04 | 3040 |
| 19... | 99 | 98 | 90 | 85 | 80 | 76 | 38 | 38 | 0 | 6.04 | 3030 |
| 20... | 99 | 98 | 91 | 85 | 80 | 76 | 67 | 8 | 0 | 6.04 | 2690 |
| Average | | | | | | | | | | | 2760 |
| Maximum value | | | | | | | | | | | 3040 |
| Minimum value | | | | | | | | | | | 2530 |
| Mean Variation from Average | | | | | | | | | | | 6.2 per cent |

As stated before, larger fineness moduli can be used with rich mixes than with lean ones. Therefore, the best value of fineness modulus will depend on both the mix and the maximum size of the aggregate. Table 3 indicates the best value of the fineness modulus for the usual mixes and sizes of aggregates. The closer the aggregate comes to meeting these values the stronger will be the concrete.

These values for fineness modulus are based on sand

and pebble aggregate for ordinary reinforced concrete. If crushed stone, slag or flat pebbles are used as coarse aggregate, or stone screenings as fine aggregate, reduce the values by 0.25. For mass work the values can be increased by 0.10 for ¾-in. aggregates, 0.20 for 1½-in. aggregate, and 0.30 for 3-in aggregate. Fine aggregate used in concrete should not have a higher fineness modulus than that given for mortars of the same mix.

### Shrinkage of Aggregates After Mixing

Table 3 gives the true mix, viz. the proportion between the volume of cement (expressed as unity and the volume of total aggregate after the fine and coarse have been combined. In the nominal mix, which is the one ordinarily used, the volumes of fine and coarse aggregates are given separately, i. e., 1:2:4 or 1:1½:3. The nominal mix can readily be converted into the true mix. Vice versa, if the ratio between fine and coarse aggregate is known, the true mix can be quickly converted into the nominal mix. For the usual ratio of fine and coarse aggregate (fine aggregate being 20 to 70 per cent of the total) the volume or total aggregate after mixing will be about ⅞ of the sum of the volumes of fine and coarse aggregate measured separately. For example, aggregate No. 6 in Table 1 contained 32 per cent sand. Four cubic feet of the total aggregate would require 4.57 cu. ft. (4.00 x 8/7) of fine and coarse aggregate measured separately. Of that 4.57 cu. ft., 32 per cent, or 1.46 cu. ft. would be sand and 68 per cent or 3.11 cu. ft. would be pebbles. A 1:4 true mix would be obtained by using

TABLE 3. BEST VALUES FOR FINENESS MODULUS

| Mix | Size of Aggregates | | | | | | |
|---|---|---|---|---|---|---|---|
| Cement— | 0—4 | 0—⅜ | 0—¾ | 0—1 | 0—1½ | 0—2 | 0—3 |
| Aggregate | | Inch | Inch | Inch‡ | Inch | Inch‡ | Inch |
| 1:7..... | 3.20 | 3.95 | 4.75 | 5.15 | 5.55 | 5.95 | 6.40 |
| 1:6..... | 3.30 | 4.05 | 4.85 | 5.25 | 5.65 | 6.05 | 6.50 |
| 1:5..... | 3.45 | 4.20 | 5.00 | 5.40 | 5.80 | 6.20 | 6.60 |
| 1:4..... | 3.60 | 4.40 | 5.20 | 5.60 | 6.00 | 6.40 | 6.85 |
| 1:3..... | 3.90 | 4.70 | 5.50 | 5.90 | 6.30 | 6.70 | 7.15 |
| 1:2..... | 4.20 | 5.05 | 5.90 | 6.30 | 6.70 | 7.10 | 7.55 |
| 1:1..... | 4.75 | 5.60 | 6.50 | 6.90 | 7.35 | 7.75 | 8.20 |

‡Considered as "half size" sieves; not used in computing fineness modulus.

a 1:1.46:3.11 nominal mix. Because of this shrinkage when fine and coarse aggregate are combined a 1:2:4 nominal mix does not correspond to a 1:6 true mix, as sometimes assumed, but to about a 1:5.2 true mix.

More accurate values for the shrinkage of mixed materials can be obtained by measuring the volume of mixed aggregate obtained by mixing fine and coarse aggregates in the proper proportions, or by calculation from the weights of unit volumes of fine, coarse, and mixed aggregates. For most cases, however, the average shrinkage of ⅛ is sufficiently reliable.

### Example 1

Four fine aggregates and three coarse aggregates are available for a certain job. Which should be used? Their sieve analyses give the following data:

| Aggregate | Per Cent Coarser than Each Sieve | | | | | | | | | Fineness Modulus | Range in Size. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 100 | 50 | 30 | 16 | 8 | 4 | ⅜ | ¾ | 1½ | | |
| Sand No. 1.... | 100 | 90 | 70 | 55 | 35 | 20 | 0 | 0 | 0 | 3.70 | 0— ⅜ in. |
| Sand No. 2.... | 100 | 85 | 65 | 40 | 20 | 0 | 0 | 0 | 0 | 3.10 | 0—4 in. |
| Sand No. 3.... | 95 | 75 | 60 | 30 | 0 | 0 | 0 | 0 | 0 | 2.60 | 0—8 in. |
| Screenings No. 4 | 85 | 80 | 75 | 35 | 25 | 0 | 0 | 0 | 0 | 3.00 | 0—4 in. |
| Stone No. 5... | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 40 | 0 | 7.40 | ¾—1½ in. |
| Pebbles No. 6.. | 100 | 100 | 100 | 100 | 100 | 100 | 70 | 30 | 0 | 7.00 | 4—1½ in. |
| Pebbles No. 7.. | 100 | 100 | 100 | 100 | 100 | 100 | 45 | 15 | 0 | 6.60 | 4—1 in. |

Because of better size and grading (larger fineness moduli) sand No. 1 and stone No. 5 are the best materials. Sand No. 2 and pebbles No. 6 are good materials, but sand No. 3 is quite fine and pebbles No. 7 are rather small. Screenings No. 4 are well graded, but an equally well graded sand would be preferable, because rounded particles find their way into place with less mixing water. That is the reason why a higher fineness modulus is permissible when sand is used than when screenings are used (See text preceding Table 3). Therefore the other materials would be better. Any of these materials will make good concrete, however, provided the fine and coarse materials are proportioned to secure a combined fineness modulus suitable to the mix and maximum size of aggregate.

### Example 2

A 1:4 true mix and a 1½-in. maximum size of aggregate have been adopted. Sand No. 2 and pebbles No. 6 have been selected because their cost is less than that of the other materials. In what proportions should they be combined to get the best results? Or in other words, what nominal mix should be used?

The proper value of the fineness modulus for these conditions is 6.00 (see Table 3). Then sand No. 2 and pebbles No. 6 must be combined in such proportions as to secure a fineness modulus of 6.00 for the total aggregate. Let P equal the percentage of sand and 100-P the percentage of pebbles.

$$P \times 3.10 + (1.00\text{-}P) \times 7.00 = 6.00$$
$$3.10P + 7.00 - 7.00P = 6.00$$
$$3.9P = 1.00$$
$$P = 0.26 \text{ or } 26 \text{ per cent}$$

Thus of the total volume of aggregate, 26 per cent should be sand and 74 per cent pebbles. The true mix being 1:4 the sum of the volumes of sand and pebbles for a one bag batch measured separately will be 4.57 cu. ft. (4 x 8/7). Of this, 26 per cent or 1.19 cu. ft. will be sand and 74 per cent or 3.38 cu. ft. will be pebbles. The nominal mix will then be 1:1.2:3.4.

### Example 3

During the progress of the work it becomes necessary to substitute screenings No. 4 and stone No. 5. What change should be made in the nominal mix?

When screenings are used as fine aggregates or when crushed stone is used as coarse, the values for the total fineness modulus given in Table 3 should be reduced by 0.25 (see text preceding Table 3). In this case screenings and crushed stone are both being used and the value of 6.00 for the fineness modulus used in Example 2 should therefore be reduced by 0.50, or to 5.50. Using the same notation as before:

$$P \times 3.00 + (1.00\text{-}P) \times 7.40 = 5.50$$
$$3.0P + 7.4 - 7.4P = 5.50$$
$$4.4P = 1.9$$
$$P = 0.43 = 43 \text{ per cent}$$

Dividing the total volume of aggregate before mixing (4.57 cubic feet), 43 per cent fine and 57 per cent coarse, the new proportions are found to be 1:2.0:2.6.

### Summary

The size and grading of the aggregate are important factors in the strength of concrete, because they affect the quantity of mixing water necessary to attain a given consistency. The fineness modulus is an index number that shows the size and grading. Therefore it reflects the quantity of mixing water that will be necessary and indicates the strength to be expected in the concrete under given conditions. It can be quickly calculated from a simple sieve analysis. The fineness modulus of any combination of fine and coarse aggregates is the weighted average of their separate fineness moduli. Study of the fineness modulus will show the proportions in which given fine and coarse aggregates should be combined for best results. Proper proportioning of fine and coarse aggregates may double the strength of concrete.

# "A Man Who Bluffs or Takes a Chance Is Soon Found Out"

## First of All, a Subordinate Must Be Trustworthy, Says President Felton of the Chicago Great Western

BY WALTER S. LACHER

"NO ONE will deny that the element of chance plays an important part in shaping the careers of men, but in most cases the outcome is determined by the way a man meets the chances as they come."

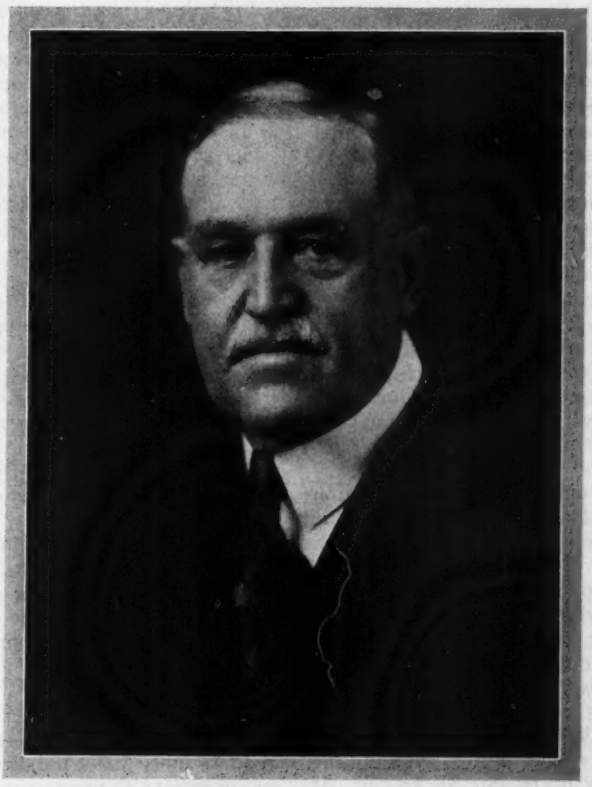
This is the opinion of Samuel M. Felton, president of the Chicago Great Western, and is founded on an experience of 32 years as a railroad president, during the course of which he has been associated in turn with the Queen & Crescent, the East Tennessee, Virginia & Georgia, the Alton, the Mexican Central, the Pere Marquette and other properties.

"Many a man," he continued, "has felt that he has had no occasion to demonstrate his ability to his superiors, but I am sure that in nearly every case you will find that the man had failed to take advantage of the chances that came his way. An opportunity does not come every day, but when it does, the man who has prepared himself thoroughly, and who will determine a suitable course of action and then carry it out to the best of his ability, can rest assured that his work will come to the attention of his superiors."

"Can you cite any such instances in your own experience?" I asked.

"Yes, there are one or two I can recall, but they differ only in detail from the experiences of many other railway men who are constantly called on to meet emergencies. In 1874, when I was general superintendent on the Pittsburgh, Cincinnati & St. Louis at Pittsburgh, I was called out of bed about two o'clock one morning to learn that a three-span Howe truss bridge carrying our double-track line over a ravine in the southern part of the city had been destroyed by fire. I went over the ground at once with the superintendent of bridges and found that the only thing to do was to build a frame trestle. The labor problem was comparatively easy. We could get enough men readily, but there was no stock of lumber on hand sufficient to complete such a large job. But this did not stop us, for by six a. m. we had a nearby saw mill at work sawing up timber into 'twelve by twelves' in lengths suitable for posts, caps and stringers.

"Our general office was then at Columbus and the general manager, who was anxious about the situation because I was then only 21 years old, sent the chief engineer to Pittsburgh where he arrived at seven p. m. After noting the progress we had made by that time, he wired the general manager that he was returning to Columbus on the first train as the work was so well in hand that there was nothing for him to do. We had trains running over the new bridge 72 hours after the fire.



**Samuel M. Felton**
*President, Chicago Great Western*

"Another emergency occurred during the riots of 1877 when mobs destroyed millions of dollars worth of property in and around Pittsburgh. To save as much of our equipment as possible, we ran locomotives into a tunnel under the city and cars loaded with valuable freight into another tunnel five miles south of the city and organized a force of volunteers to protect the portals with rifles and shot guns and saved the equipment.

"As I said before, these emergencies come to every man in active railway service and it is his plain duty to meet them as they come to the best of his ability."

There is little doubt but that these two occurrences had something to do with Mr. Felton's later promotion. Other advancements followed, leading to his election in 1885 as first vice president of the New York, Lake Erie and Western in charge of traffic as well as operation. Later, in 1890, he was elected president of the East Tennessee, Virginia & Georgia and the Cincinnati, New Orleans & Texas Pacific. One instance relating to Mr. Felton's connection with the latter property, concerns the transportation of troops during the Spanish-American war. The War Department did not have the transportation matters as well in hand at that time as during the late war, with the result that in the morning of one day, 30 train loads of troops were jammed into Cincinnati by the Baltimore & Ohio, the Pennsylvania, the Big Four and the Cincinnati, Hamilton

& Dayton, for movement to the Chickamauga military camp near Chattanooga. However, in spite of this unusual and entirely unexpected concentration of traffic, the Cincinnati, New Orleans & Texas Pacific handled these trains south out of Cincinnati at ten-minute intervals over a single track line and delivered them in Chattanooga on scheduled time. This performance of the transportation forces under Mr. Felton's direction attracted attention and, no doubt, played some part in his selection the following year by E. H. Harriman for the presidency of the Chicago & Alton.

Some men achieve positions of considerable responsibility much earlier in life than others do, but not many men are general superintendents at twenty-one. It was, therefore, natural to ask Mr. Felton concerning the reasons for the wide disparity in the rapidity with which men receive promotion.

"The sooner a man starts, the better," he replied. "If a man wishes to start early, he must decide early what he wants to do. I think that a boy ought to have his mind made up by the time he is fifteen. In my own case, I was only ten. Because my father was a railway officer I had opportunities to obtain an intimate contact with railroads. I rode in engines and cabooses, visited shops, roundhouses and freight stations, and was thoroughly interested in everything that had to do with railroading. When I was fifteen I worked as a rodman on the Chester Creek Railroad and for the period of each summer vacation during my school years, I worked in some engineering capacity until I graduated from the Massachusetts Institute of Technology in 1873. During the last of these vacations I was engineer of surveys on the Chester & Paoli Railroad for the Pennsylvania Railroad. Because of the practical experience I had obtained in this way, I was not only able to complete my course of study in considerably less than the four years required, but qualified for the position of chief engineer of the Chester & Delaware River Railroad upon graduation. A year later I became general superintendent of the Pittsburgh, Cincinnati & St. Louis."

"Is the young man who occupies a responsible position at a considerable disadvantage because of his youth; doesn't he have difficulty sometimes in making older men take him seriously?"

"He must not let such opposition deter him for a moment," was the emphatic reply. "Of course, he will run counter to certain people, but it is up to him to go ahead with what he has set out to do. The important point is to make himself indispensable to his immediate superior. To do this, he must know what a man expects of a subordinate. First of all, he must be trustworthy. If I ask a man a question I expect him to give me the information promptly and accurately—*if he knows.* If he doesn't know, or isn't quite sure, I want him to say so. A man who bluffs or takes a chance is soon found out and after that, his answers are not given much consideration. Unless a man is accurate in his routine work, in his reports and in his conversation, he is not of much value."

"But isn't executive ability the real limiting factor?"

"Yes, that is true. Few men reach the top. The others stop at various places along the way because they haven't it in them to do as well as those better qualified. But that does not mean that every man shouldn't try to get just as far as he can."

"Isn't native shrewdness or ability as a bargainer an essential for success, particularly in a man's contact with the public?"

"I am not inclined to consider that so seriously. If a man is earnest, sincere and forceful in his efforts, he will generally develop into a good trader. People are inclined to think that executive ability is something in the nature of a gift that is born in a man. In a measure this is true, but native leadership alone will not make a man a success as an executive. One of the most important factors is the extent of his knowledge of the work being done under his direction. The executive who is entirely dependent on his various subordinates in arriving at decisions on the many technical problems that come to his attention is seriously handicapped. If he cannot pass intelligently on engineering problems or cannot develop his own conclusions concerning the requirements of new equipment or problems in other branches of railway service without relying entirely on his department heads, his success depends almost entirely on the ability of the men under him.

"There are times when he *must* decide on many matters without taking counsel with others. For instance, in 1916 when we were on the verge of a war with Mexico and had concentrated a large force along the Rio Grande river, I was asked by the chief of engineers of the United States War Department to take charge of the transportation details of the preparations for an advance to Mexico City. This involved not only complete arrangements for all of the cars and locomotives required to move great numbers of troops and the supplies that must go with them, but required preparations for the complete assembly of all material and equipment necessary to rebuild the tracks and structures as fast as they would be destroyed by the retreating enemy. This, of course, involved detail that had to be gone through very quickly, something that no man could have done within the time available unless he had a detailed, first-hand knowledge of the requirements himself.

"This same situation arose the following year when I was called on to take over the organization and fitting out of the transportation forces for the United States Army in France. This, of course, had to be done quickly and it was entirely out of question to wait for the deliberations of a board of experts to determine upon the quantity and character of equipment required. I had to decide at once what kind of locomotives would be suitable and get them ordered without delay (the first one was delivered in twenty-one days' time). The same principle had to be followed with respect to rails and other track materials and the construction outfits, including locomotive cranes, steam shovels, pile drivers and everything else that is required to build and operate a railroad."

"But wasn't the problem of personnel a difficult one also?"

"Yes, most interesting. It was not only necessary to recruit railway men of experience in all the different classes of railway employment, but they had to be organized into units under the direction of qualified officers. It was necessary to know what kind of men were necessary and where to get them. You musn't understand from this that there was anything essentially unusual about the requirements of this work. The things that were expected of me are those that every railway executive must know."

"The requirements you have outlined would imply that a man must obtain experience in a great many different departments of the railroad before he is qualified to occupy any of the higher positions."

"That is not necessarily true. If a man wants to get ahead at all on a railroad, he must put in all of his spare moments learning all that he can about railroading. If he is a division engineer, for instance, and is compelled to spend a large part of his time traveling up and down the line, he is afforded excellent opportunities to come in contact with all phases of railroading. He should make it a point to ride on engines and ask questions of the engine crew so that he could actually run a locomotive himself.

He must talk to station agents about their work so that he may gain a knowledge of station service, and if he follows this practice constantly and does not overlook any opportunities to add to his knowledge, he will gradually learn those things which will be a great help in his advancement. He cannot learn too much about his work."

# Pumping Water Against a 350 ft. Head

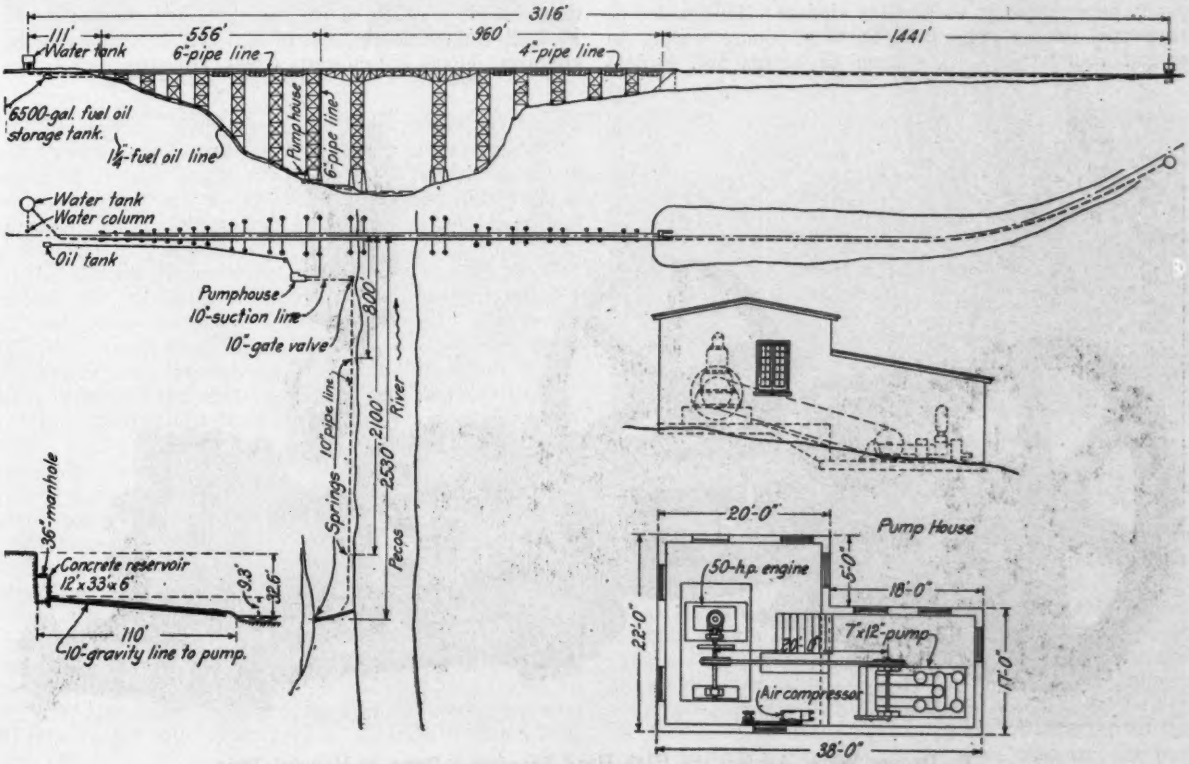
A PUMP, working against a total gravity head of 351.5 ft. through a delivery pipe attached to one of the columns of the famous Pecos viaduct, comprises the most spectacular feature of an unusual water supply plant on the Southern Pacific Lines in Texas, and illustrates the difficulty of obtaining suitable supplies in some portions of the southwest. The water supply is obtained from a spring which empties into the canyon from a crevice in the canyon wall at an elevation 12 ft. above ordinary low water in the Pecos river. The water from this spring is very clear and is excellent for either drinking or boiler purposes. The obstacle imposed by the site lay in the fact that this source of supply was a half mile south of the bridge and over 300 ft. below the elevation of the track.

**The 100,000 Gal. Tank Is Reinforced Concrete**

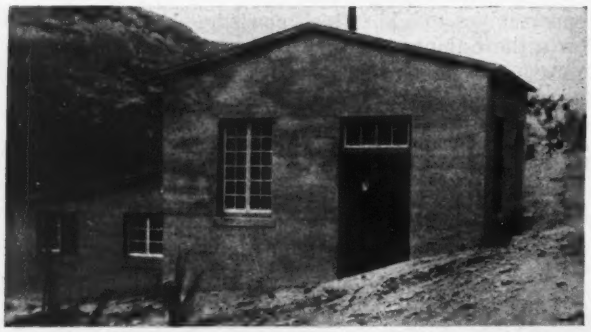
It was deemed desirable to provide a storage tank and water column at each end of the bridge because all trains are required to make a full stop before crossing the viaduct and it was thought desirable not to stop the trains on the viaduct structure as a regular practice. Accordingly, it was found most economical to build the pump house below the center of the viaduct with a 6-in. discharge line extending up one of the tower columns to the deck, whence a 4-in. pipe line was extended 2,360 ft. west to one tank and a 6-in. pipe, 756 ft. east to another. Advantage of the presence of the pipe line on the deck of the bridge was taken for the purpose of providing 13 fire hydrants with hose lines conveniently located for fire protection to the wooden deck. This precaution was afforded in spite of the fact that the ties are covered with sheet metal.

The water from the spring was impounded by enclosing the spring in a concrete box 12 ft. by 33 ft. by 6 ft. high, from which a 10 in. pipe line extends for a distance of approximately 2,750 ft. to an overflow gate on the banks of the Pecos river near the viaduct, where a connection is made with a 10-in. suction line to the pump house. Provision is made for a supply of water from two other springs on the delivery line, which is laid so as to give a gravity flow to an elevation at the overflow gate valve of 686.5. The suction lift from the lower end of the delivery line is 18 ft.

To deliver water against the high pressure imposed by



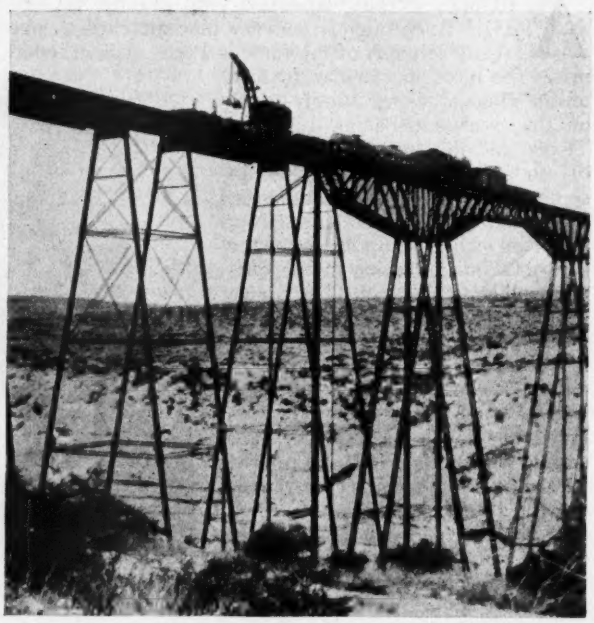

**The Pipe Line Extends Vertically Over 300 Ft. to the Deck of the Viaduct**



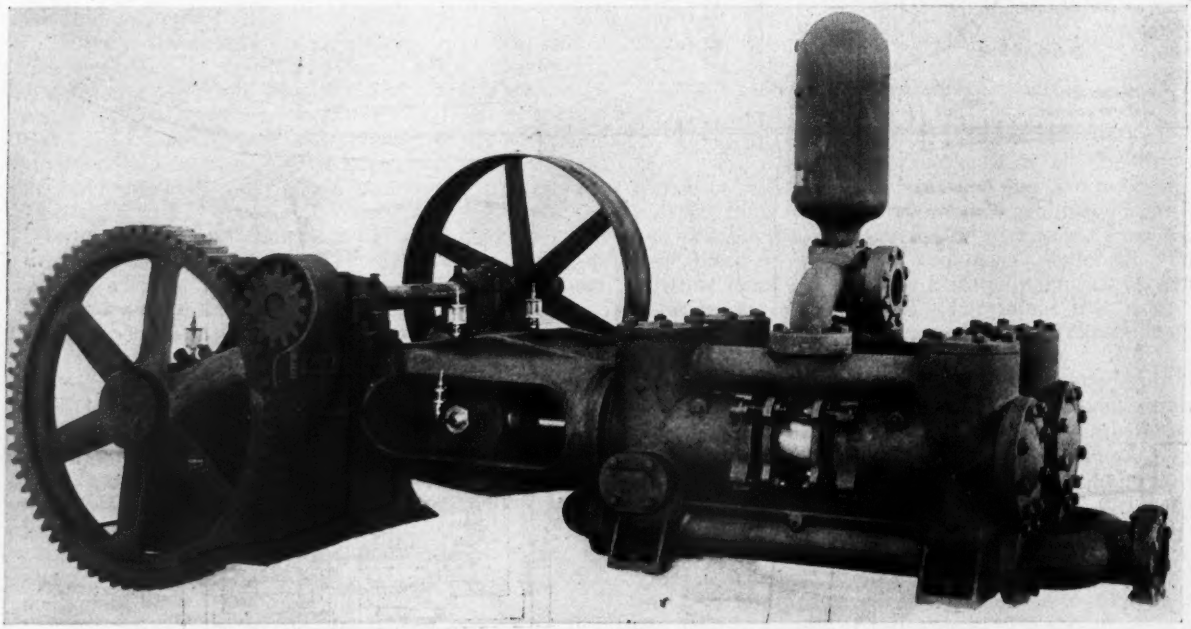
**The Pumping Plant Is Housed in a Reinforced Concrete Building**

the conditions required a pump of unusual type, for which a 7-in. by 12-in. outside center packed duplex plunger pump was provided by Fairbanks, Morse & Co., Chicago. This pump, which under normal operation delivers 300 gal. per min., is driven by a 50-hp. type Y Fairbanks Morse oil engine operated on distillate. An auxiliary air compressor plant is provided to supply compressed air for starting the pumping engine. This pumping plant is housed in a reinforced concrete building 38 ft. by 22 ft., located 50 ft. up stream from the nearest viaduct tower pedestal. Oil is supplied to the plant through a 1¼-in. fuel oil line running from a 6,500-gal. fuel oil storage tank located in the vicinity of the track at the east end of the bridge. There is also an auxiliary storage tank near the pump house in the form of an engine tender. One of the most interesting features in connection with the construction of the plant was the lowering of the pumping machinery and engine tank to the site of the pump house from the cars on which they were delivered to the bridge. One of the company's wrecking cranes was used for this purpose, as is shown in a photograph.

One of the water supply tanks forming a part of this project is a reinforced concrete tank of 100,000-gal. capacity located 200 ft. east of the viaduct. This tank was supported on five columns 2 ft. 6 in. square resting on spread foundations. A system of beams and girders framed into the top of these columns support the 6-in. floor of the tank, which is 30 ft. in diameter by 20 ft. high. The tank was poured in two stages, the first stage completing the floor and columns, the second the shell, which is separated from the floor by a sliding joint protected with a copper sheet 1/16 in. thick, coated on both sides with graphite and sealed with asphaltic cement. The cost of the tank was $5,825, an amount which is considerably higher than the officers of the railroad feel that the tank could have been built for at a more favorable time. We are indebted for the above information to H. M. Lull, chief engineer, and E. A. Craft, assistant to chief engineer, Texas & Louisiana Lines, Houston, Tex.



**The Pump Was Lowered Over the Side of the Viaduct**



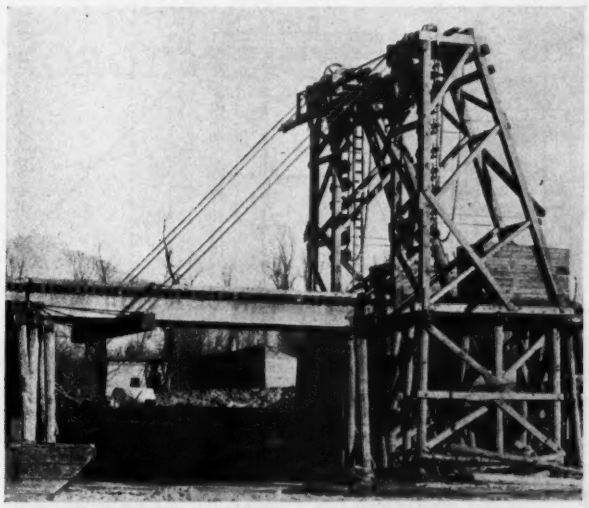
**To Deliver Water Against the High Head Required a Pump of Unusual Type**

# Canadian National Builds An Ingenious Lift Bridge

### All Timber Structure in British Columbia Fulfils Requirements At an Unusually Small Expenditure

A LIFT BRIDGE in which all parts are of timber except the machinery, and that of the simplest character, was developed for use on the Sumas river bridge in British Columbia under circumstances calling for only an occasional opening. The design is especially to be commended as one which provides for the requirements of the site at a minimum of expenditure.

The line of the Canadian National crosses the Sumas river practically at its confluence with the Fraser river,



**The Old Deck Was Made Into a Lift Span**

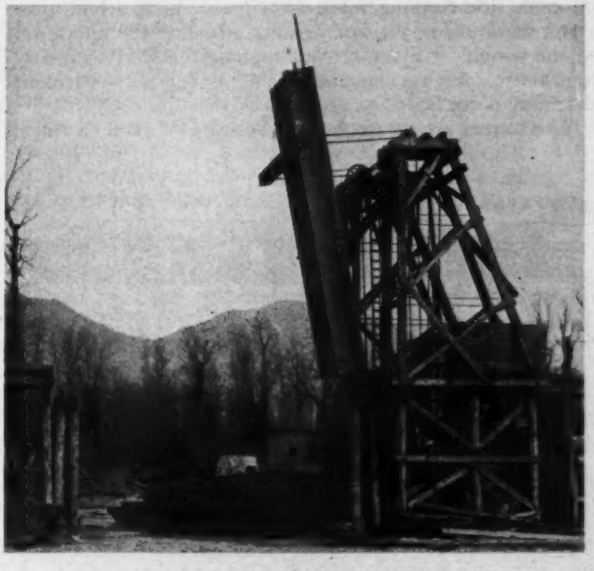
53 miles east of Vancouver, B. C. The crossing is effected by means of a standard pile trestle 405 ft. long, and having a maximum height of 38 ft. from bottom of river to rail level. Back water from the Fraser river creates the high water elevation at the bridge, which is within a few feet of rail level.

The Sumas river in its upper reaches empties into Sumas lake, while the lower reaches of the river provide an outlet from the lake into the Fraser river. The possibility that boats or dredges might occasionally pass from the Fraser river through this bridge on the way to Sumas lake, prompted the railway to provide a makeshift channel span at the time that the bridge was constructed in 1911. This was done by arranging that the portion of the bridge between bends 11 and 14 (about 40 ft.), that is, the ties, stringers, bents, etc., could be removed and again replaced with a minimum of difficulty.

This arrangement sufficed until 1920, when the Sumas lake reclamation project, with the prospective passing of large barges and dredges up the Sumas from the Fraser, called for an improvement in bridge opening facilities. Accordingly, bents 12 and 13 were removed altogether, and the entire space between bents 11 and 14 was spanned by six timber stringers, each 16 in. by 32 in. by 42 ft. long. After this change was made it was necessary only to remove and later replace 42 ft. of deck to pass a boat through.

As the weight of the timber in the deck is considerable (each stringer weighing nearly three tons) the plan implied the use of power hoisting equipment which normally would have to be brought from division headquarters. However, during the winter of 1920-1921 it became evident that something in the nature of a movable span would have to be provided and with this object in view, a lift span was designed and constructed. But since the need for a movable span at this point will disappear with the completion of the dredgings in the Sumas lake region, only a temporary structure of limited cost was required. The photographs illustrate how this was accomplished by transforming the existing movable portion of the deck into a lift span operated by means of a hand winch through the application of balance weights and chains and the provision of strong hinges.

A frame tower was built over the track close to the movable span, with standard clearances over the track. This tower provides support for the shafting, chain wheels, hand winch and balance weights. Four one-inch diameter chains, two on each side of the deck, are attached at one end of each to a timber yoke which passes underneath the stringers. Back stays are provided, trans-



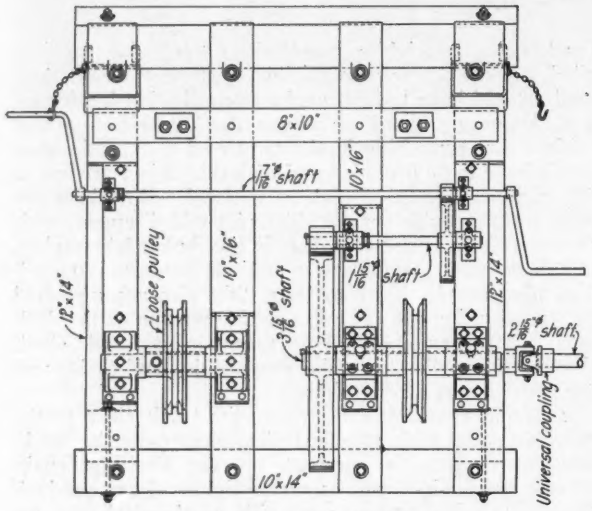
**The Bridge Is Raised by Hand**

ferring the components of the chain pulls parallel to the deck into the stringers.

The chains pass over chain wheels fixed on shafting at the top of the lower tower and a series of nine balance weights on each side. These balance weights are built up of segments, each segment being in two halves bolted together over a horizontal cross bar connected to the two chains. This arrangement provides for adjustment and allows the span to be balanced accurately. The balance weights aggregate about 27,000 lb. on each side. The loose ends of the chains are hung back to the top of the tower in such a way that, as the span rises and the pull in the chain is reduced, the weight of each balance weight

is transferred successively to this back chain until but one balance weight on each side remains acting on the span when the span is full open. In this way the span is overbalanced and underbalanced alternately, the difference between balance weight and chain pull at any point being taken up by the winch.

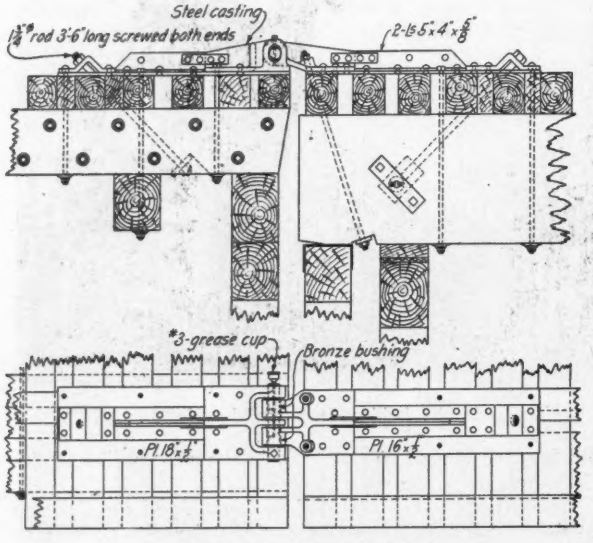
The winch has a double crank, and drives one chain




**The Winch Has a Double Crank**

wheel on each side of the tower, the other chain wheel on each side running loose on a fixed shaft. This prevents variation in the link centers affecting the operation of the winch. Universal couplings on the shaft connecting the two driving chain wheels allow for any settlement that may occur.

The hinges are of ample size, built up of steel castings,

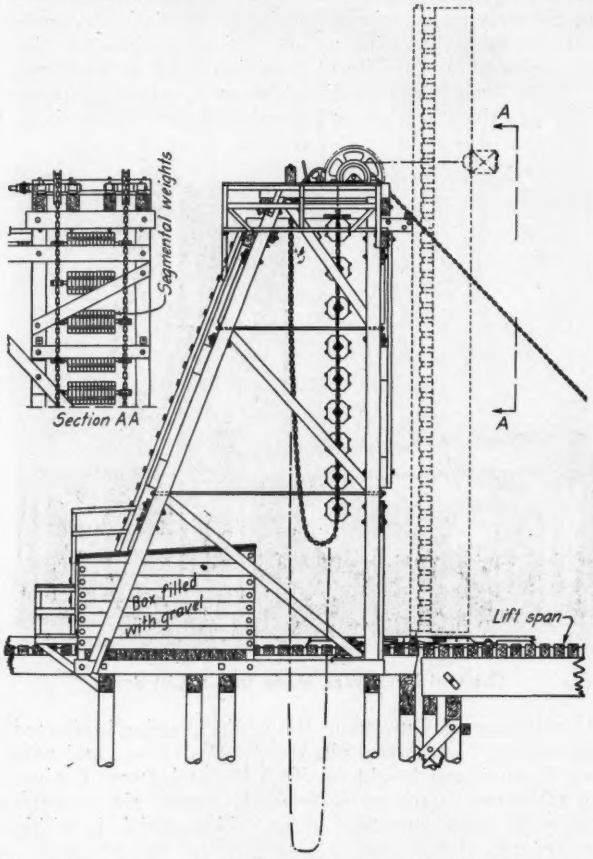



**The Hinges Are Steel Castings**

plates and angles. The hinge pins rest in slotted holes, the slots being vertical, providing for some free vertical movement of the lift span relative to the fixed deck when traffic is passing. When the span is closed the hinge pin is located in the center of the slot and must fall to the bottom before the load is taken by the hinge when raising. Two large boxes filled with gravel, one on each side of the tower, provide the weight necesary to balance the tower against the pull of the lift span when raising.

The work of installing the towers, machinery, etc. was completed during August, 1921, and the structure has proved to be eminently satisfactory. It provides a clear span of 36 ft., and the operations of raising and lowering the span each occupy four minutes, using four men. In all probability this record will improve after more extended use.

The problem at this structure was to provide a navigation opening which could be available at short notice, but which would be required only for a comparatively short period of time. Hence the necessity for limiting




**A Frame Tower Was Built Over the Tracks**

expenditure. It is worthy of note, therefore, that the completed structure cost only $8,160, and was installed without delaying traffic or discarding any portion of the original structure.

This structure was designed in the bridge department of the chief engineer's office, Winnipeg (H. A. Dixon, chief engineer). All computations and details were worked out by H. Lorimer, designing engineer, under the guidance of J. G. Legrand, bridge engineer, who developed the idea from his recollections and personal knowledge of many fortification drawbridges or "ponts levis" in France and England.

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RAILWAY EARNINGS IN SEPTEMBER.—The Class I railroads had a net operating income of $58,428,000 in September, according to reports filed with the Interstate Commerce Commission. This represents a return, on an annual basis, of only 2.88 per cent on their tentative valuation as compared with 4.32 per cent in September last year.

*The Banquet Was Held Wednesday Evening.*

# Roadmasters Hold Successful Convention At Cleveland

## Fortieth Annual Meeting Characterized by Unusual Interest, Practical Reports and Attractive Exhibits

THE fortieth annual convention of the Roadmasters and Maintenance of Way Association which was held at the Hotel Statler, Cleveland, on November 21-23 inclusive, was one of the most successful in the history of that organization. The attendance of nearly 400 members was particularly indicative of their interest in the work of this organization because of the strenuous period through which the members have passed, which conditions made necessary the postponement of the convention from its accustomed time in September. The reports were among the most practical which have ever been presented before this organization and brought out active discussion.

### Opening Exercises

The convention was called to order promptly at 10 o'clock on Tuesday morning by L. M. Denney, president, who introduced C. E. Denney, vice-president and general manager of the New York, Chicago & St. Louis, Cleveland, Ohio.

In welcoming the convention to Cleveland Mr. Denney referred to the new passenger station which is in immediate prospect and for which land is now being purchased. Emphasizing the importance of co-operation in the solution of railway problems, he described the method by which the Cleveland railways have avoided congestion in that terminal, the officers of all lines entering that city meeting informally at luncheon once a week to discuss their difficulties and to apply their united facilities to the solution of the problems which arise. These informal conferences have made it unnecessary to appoint a formal Car Service Commission and their problems have been met currently as they arise. In concluding, Mr. Denney emphasized the fact that no road can afford to have a man in a responsible position who does not take an active part in association work and avail himself of the opportunities which an organization affords for the exchange of information with other men similarly employed. He stated that one good idea applied on a division will be worth the cost of attendance for many years.

L. M. Denney reviewed the progress of the association during the past year. He called attention to the development of the transportation industry in America during the 90 years of its existence and emphasized the necessity for every railway employee to perform his particular duty efficiently if the railways are to serve the public economically. He said in part: "Men of the maintenance of way department who realized the importance of maintaining track economically, organized the Roadmasters Association in order that they might exchange ideas regarding maintenance problems. For 40 years this association has met regularly and discussed matters pertaining to their work. With the designing of heavier motive power and the construction of larger cars, the problems of track maintenance have increased, thus creating a field for greater activity and an opportunity for more valuable work by the association. The topics which have been selected for consideration at this convention reflect these developments."

## The Roadmaster's Responsibility for Loyalty

By C. A. Paquette

Chief Engineer, Cleveland, Cincinnati, Chicago & St. Louis

TO me the track is the most wonderful part of a railroad—not in its design nor particularly in its use—but because of the human element connected therewith. The maintenance of equipment is performed at certain concentrated points on a railroad, and, therefore, is subject to close supervision and direction, but maintenance of way work is performed on every foot of a railway from one end to the other by men strung along the line with supervision that must be more or less general in character. When an emergency arises nobody higher in authority than the track foreman is at hand, and it is on his judgment, his watchfulness and his resourcefulness that we depend for the safety of trains. It is to this factor that I want to direct my remarks particularly.

The president of the New York Central made the remark in a public utterance some months ago that 95 per cent of railroading consisted of the human element; in other words, the efficiency of the railroad depends upon the organization and upon the co-operation of each member of that organized unit. In your department the cost of labor is greater than the cost of ties, rails, fastenings, ballast, bridges and all other materials combined. The big question, therefore, is how to get efficiency out of the applied human effort. I have known many track foremen have ridden hand cars and motor cars and have stopped to talk to these men—earnest, honest, loyal, pains-taking, always speaking of the line as "our railroad," men who took a pride in their work and a genuine satisfaction in its accomplishment. The regretful thing is that there has been a marked change in the attitude of many of these men in the past three years.

We had, for the past 15 years, seen attempts on the part of professional organizers to get all classes of railway employees associated into unions covering the various lines of activity. Hard on the heels of Government control, politicians, seeing the opportunity for the creation of a political machine, fostered organizations of these men under the guise of convenience in having the men represented by the heads of outside organizations in negotiations covering wages and working conditions. Organizers, watchful of self-interest, saw their golden opportunity and were not slow in availing themselves of it.

A short time ago a railway executive was talking to me about the deplorable situation which had developed, saying that the old-time loyalty of railway employees now seemed to be a thing of the past. I told him that he and the rest of the railway officers were to blame for it. We had seen attempts to inoculate these men with the virus of discontent and suspicion, and, yet, what had we done to overcome it? The small units of railroads of the past were swallowed up into larger organizations through consolidation, and the old days when the president or general manager knew "Bill," the engineer, or "Jerry," the section foreman, by his first name passed away. Nowadays the superintendent is too busy looking over reports and dictating mail to know the trainmen, much less the track men. The division engineer who knows all of the track foremen under him is an exception.

We have lost much of the human element in the past two or three years because of the new influences that have been injected between the railroad and the employee —elements that are fostered and can thrive only through the breeding of discontent of employment and suspicion of the motives of the employer. A few days ago I was visited by a track foreman and a bridge foreman. They were both excellent craftsmen in their line, upstanding, thoughtful, earnest men who sought an interview with one thought in their minds. They said "We have yet to hear a single word said on behalf of the railway company in any meeting of our union. All we hear is fancied grievances on the part of some men, or the discussion of some plan by which the railways can be made to come across in some feature or other, and we came to the conclusion some time ago that we could not be loyal to the railroad and to the union. We want to know the way out." These men were in earnest. They have been in the employ of the railroad for 15 or 20 years. They said that in all of their terms of service they never had any reason to impugn the motives of their railway officers and that they had been dealt with in such a way that they were in duty bound to maintain their loyalty to their employer above all outside considerations.

This is a nation in whose veins flows the blood of pioneers. To individual energy, ambition and resourcefulness is due the success given to each man. Are we going to destroy that by this new philosophy? Are we going to measure the ambitious and efficient by the same yard stick as we do the indolent and the worthless, whose only concern is to do just enough to hold him in his job? If we do, we destroy that which has made our country great. We relegate the workers to an industrial equality which is colorless mediocrity. We stifle ambition, energy, the things that give mental satisfaction and material rewards to the deserving. Do we want this? Do the workers of the country, as a class, want it? I don't believe it.

I have been more concerned over the situation with respect to the maintenance of way foreman and the marked change in his attitude than over any other one phase of the problem. We must find a way to regain his confidence, his trust, his old-time interest and pride in his work. You cannot make me believe that these things have disappeared from him. They are merely submerged for the time being.

One of our statesmen said some time ago that what this country needed more than anything else was a good nickel cigar for five cents. There is a great deal of true philosophy in this remark. What we need is a return to a sense of proportion and a sense of true values. What we need is value given for value received and, by the same token, value received for value given. In the past two or three years the employees of railways have lost their correct sense of perspective. It is our duty to help them regain it.

You are the connecting link between the railways and their maintenance of way employees who actually do the work. Upon you rests the responsibility for reestablishing the relations that never should have been disturbed and which would not have been if we had been half as energetic as the outside interests. With you rests the intimate connection that closes the circuit between the roadmen and the railway company in whose service they are. It does not detract from your dignity to say to the track foreman, "Hello, Jim, is the little girl better than the last time I saw you," or "Bill, is your boy still going to school?" Manifest something of the bond of human sympathy that should hold us together. Don't lose sight of the value of personal contact with your men, a word of commendation for a job well done, a word of encouragement to the persevering and a word of help where bolstering is needed—you will find that this will mean much to these men.

Your men frequently want advice, they want somebody to whom they can talk about their personal affairs as well as about their railroad business. Be that man! Don't let it be confined to lodge officers. Under a situation such as now exists you are derelict in your duty if you stand on the side lines and look on. Don't widen the gap; close it! This is no time for temporizing. Stand up and meet trouble-making demagogues and discontent-breeding organizers with as much energy as they have. Regain the old feeling of personal interest and attachment that once was a marked characteristic of the foreman. There and there only is the path to efficiency. Only when your men have their minds fired with enthusiasm, and the word "loyalty" graven in their hearts, can you say that you have properly performed the functions of your important office. So long as the employees of the railway feel that their first duty is to an outside organization—one whose objects are antagonistic to that of the railroad—that long will we have discontent and turmoil upsetting the relations that properly should exist between employer and employee—a poison gas rolling over the country, blighting honest effort and worthy ambition—and until we cure this evil it is vain for us

*The Room Was Well Filled on Wednesday Morning.*

to stand up and try to chant "My Country, 'Tis of Thee, Sweet Land of Liberty."

## Economic Advantages and Methods of Maintaining Motor Cars

MOTOR CARS for railroad section and inspection purposes were first used, we believe, in 1909. At that time their seeming advantages over hand cars were so great that any car that was equipped with a power unit to propel itself over the tracks was acceptable. Today, however, the efficiency and economy of the motor car have been proven beyond question, so that the only problem remaining is to secure the best type, with sufficient power and flexibility to perform the work required without too great weight. At the same time it must be of sufficient strength to withstand the rough usage it receives and not deteriorate too rapidly under the severe weather conditions under which it is operated.

In order to consider the different phases of the subject, your committee has treated it according to the following divisions:

1. **Design.**
   - A—Chassis construction.
   - B—Power requirements.
   - C—Power plant design.
   - D—Type of drive (facility of operation).
2. **Economy.**
3. **Maintenance.**

### Chassis Construction

To obtain maximum efficiency, the motor car must be of sturdy construction. The frame members must be stiffer than those provided for hand cars and must be so placed that motor vibration is reduced to a minimum. This result is probably better obtained by a steel frame and this type should be specified.

The weight of the car must depend largely on the size of gang and the amount of material hauling required. It should always be borne in mind, however, that the force available for handling the car on and off the track, will frequently be reduced to four men. The weight, therefore, should not greatly exceed 1,200 lb., or if it is greater, some mechanical device such as a turntable or center jack should be carried to facilitate handling. One pair of wheels should be free, that is, have a differential action with the larger part of the dead load distributed to this end so as to permit the turning of the car from the track at right angles.

In the use of a light car for inspection or signal service, the weight should be so distributed that an even torque is obtained in driving, and so balanced that the load will not tend to derailment. This can only be accomplished with the center-load car. Although certain advantages may be claimed for the so-called speeder type, they are largely visionary and the danger of operation overshadows them.

The motor car must have certain features of convenience and safety, which are largely left to the purchaser's discretion. First, adequate space must be provided for tools; this is important and also includes a safety consideration. Tool trays should be placed on each side of the seat platforms of sufficient depth to preclude the possibility of any tools slipping forward over the front of the car. Although most makes may be operated for short distances backward, the front and rear ends should be designated and the car operated accordingly. This will permit the installation of high pipe rails on the front and rear, securely fastened to the floor and connected by a longitudinal center rail. This safety rail arrangement facilitates mounting and prevents men falling from the car. A protecting screen should also be placed at the front end of the car to retain the load.

A safety item of prime importance is the protection by shields of all moving parts of the power plant. This precaution will prevent injury to clothing and persons of employees, and also avoid the damage resulting from tools projecting into the working parts.

### Power Requirements

The factor of power is influenced by many considerations. It is, of course, not desirable to load down the four or six man section with a heavy car; their needs will be better suited by a lighter machine of not less than six horsepower. Then, again, it may be that on some railways material must be handled largely by the motor car, requiring a heavy duty type. Probably the greatest limiting factor on power is the grade encountered. It must be remembered that even a short distance is a ruling grade for the section car. Also weather conditions must be considered in determining the power required, and head winds as well as excessively high or low average temperature must be noted, as, for instance, an air cooled car might work effectively in a cooler climate, but not so well in a warmer one. After the horsepower is decided, care should be taken so that the dead load will not exceed 150 lb. per horsepower.

The driving ratio should be calculated to secure the maximum efficiency from the engine speed for power purposes; that is, speed should always be sacrificed to power, but not to the extent, of course, of heating the motor under reasonable speeds. However, 20 miles per hour

should be considered a maximum speed from a safety standpoint.

## Power Plant Design

Two different types of motor cars are available for railroad use, namely, the four-cycle and the two-cycle, differing entirely in the principle under which they operate. They are ably described by an expert as follows:

"The four-stroke cycle engine, better known as the four cycle engine, completes a full operation in every four movements of the piston in the following order: suction, compression, explosion, exhaust. In the downward movement of the piston, creating a vacuum in the cylinder, the intake valve opens mechanically, permitting a charge of gas to enter the cylinder. At the completion of the first stroke this valve closes, the piston then rising in the cylinder on its second stroke and compressing the gas, which is then exploded by an electric spark, driving the piston down on its third or power stroke. On the fourth or upward stroke of the piston, the exhaust valve opens, releasing the burned gases and completing a full cycle.

"With this method the gas enters the cylinder *only*, in any quantity desired, depending upon the opening of the throttle valve in the carburetor, making it possible thereby to operate the engine at any required speed consistent with the conditions under which it is being used. Efficient cooling of a four-cycle engine is also possible owing to the complete exhaustion of all burned gases, which is essential to the proper working of any internal combustion engine.

"The two cycle or two stroke cycle engine completes a full operation in every two movements of the piston, the downward movement being the power stroke which, at its completion, forces a fresh or unignited charge of gas into the cylinder through a by-pass, which is then compressed on the upward stroke, the details of which are as follows:

"The two cycle three port engine, being constructed without valves, draws the gas from the carburetor directly into the crank case through a port opening in the bottom of the cylinder, which is uncovered at the completion of the upward stroke of the piston. On the downward movement this gas in the crank case, compressed to about 4 to 6 lb. per square inch, is forced therefrom into the cylinder through a port in the latter, which is uncovered by the downward movement of the piston. This movement of the piston also uncovers another port on the opposite side of the cylinder through which the burned gases escape. As these two ports open at nearly the same time, the fresh charge of gas enters the cylinder before the complete exhaustion of the burned gases, and in an effort to keep the new gas from mixing with the burned gas, the top of the piston is fitted with a baffle plate against which the fresh charge strikes, diverting it toward the top of the cylinder. This arrangement, therefore, results in an incomplete exhaust and also a loss of part of the fresh gas through the exhaust port, which, being partially burned in the cylinder, causes excessive heating.

"Inasmuch as the gas is first drawn into the crank case, from which point it is forced into the cylinder by the movement of the piston, it is very evident that the crank case must be of a size in proper proportion to the size of the piston. For instance, if the crank case is too large, the pressure formed therein will be lower than required and only a portion of the new charge will be forced into the cylinders. From this, it is easily seen that even with a crank case and piston of the proper size, it is necessary to fill the crank case completely through a wide open throttle, in order that it may be fully compressed and forced into the cylinder. This inability to throttle a two cycle engine, or, in other words, to prevent the generation of the full horsepower at all times, results in any car to which such an engine may be directly connected, being operated efficiently at high speed only.

"The lubrication of a four cycle engine is usually accomplished by means of the splash system by the use of small projections on the bottom of the connecting rods which dip into a supply of oil, the level of which is maintained by means of a positive gear pump. By this method all of the moving parts of the engine receive ample lubrication, the amount of oil supplied being regulated mechanically by the engine builders. This, of course, is based on the use of suitable grades of oil to meet the varying climatic conditions.

"With the two cycle engine, the crank case and cylinder of which are under compression at all times, the most satisfactory method of lubrication is to mix the lubrication with the gasoline and feed it through the carburetor, the standard practice being to add one-half pint of oil to one gallon of gasoline, which is the maximum amount of oil that can be used without interfering with the successful vaporization of the gasoline. Any increase in this amount will also have a tendency to gum up the needle valve of the carburetor. Under favorable conditions, this method of lubrication works fairly well, but when working under high temperature, load and grade conditions, it is very desirable to be able to feed a large amount of oil, with the result that two cycle engines are frequently run with insufficient lubrication.

"Little wear of the various moving parts of a four cycle engine takes place due to the lower heat at which it operates on account of the more perfect exhaust and less frequent explosions and the positive and always ample supply of lubricating oil. In addition, the efficiency of this type of motor depends much less upon the perfect fit of its main bearings, which parts, of course, are subjected to more wear and shock than any other part of the motor.

"Due to uncertain lubrication and excessive heating, through the frequent explosions and slow combustion, two cycle engines are more subjected to carbon troubles in both cylinders and crank case, through burning of the lubricating oil, which naturally results in wear of the pistons, rings and cylinder. The principal cause of the loss in efficiency, however, of a two cycle engine is in the wearing of the main bearings."

As explained in the description above the supply of gas is being drawn into the crank case, from which it is forced into the cylinder under a pressure of from 4 to 6 lb. If the main bearings do not fit perfectly a poor vacuum will be created, resulting in a reduction charge being drawn into the crank case from the carburetor. On the return stroke of the piston, to force this gas into the cylinder, a certain amount of the already reduced charge will escape in a similar manner, as well as some of the lubricating oil contained.

### Distinguishing Features

**Four Cycle.**

Economy in fuel.
Efficient combustion.
The four functions of the cycle (intake, compression, explosion and exhaust) are controlled mechanically so that they do not overlap one another.
Positive lubrication of all moving parts.
Good running due to fewer explosions.
Less ignition trouble on account of the lower speed at which the magneto operates.
Maximum efficiency possible due to adjustable features.

**Two Cycle.**

Fuel extravagances on account of losses through exhaust and bearing leakage.
Imperfect combustion owing to poor scavenging of the cylinder.

No mechanical means to keep intake and exhaust gases separated.
Uncertain lubrication.
Simplicity of design and fewer moving parts preclude finer adjustment."

In considering the use of four cycle and two cycle motors, it is well to keep in mind that practically every pleasure automobile, motor truck, motorcycle and airplane motor is of the four cycle type, their general use in airplanes in particular and the fact that numerous automobile companies have discarded their originally adopted two cycle engines in favor of four cycle, indicating without question their greater efficiency and reliability. On the other hand, two cycle engines are well adapted for slow running heavy duty marine service.

In the two cycle type, the necessity of feeding a fixed amount of oil with the gasoline through the carburetor in order to provide the requisite lubricant for only favorable conditions, without being able to take care of this feature properly under high temperature, heavy load and grade conditions, renders this type, in our opinion, unfit for the miscellaneous class of work which a railroad motor car is called upon to do.

The human coefficient of efficiency is not sufficiently stable, and never will be, to give the requisite amount of ordinary ordinary honest effort necessary to operate the two cycle type under the favorable conditions for which this class were designed. In the four cycle type, each necessity to its operation is separately confined and is applied automatically from separate reservoirs, any man failure is easily apparent and the necessary corrective measures can be applied at once, which is an essential feature in securing longer life from the car and lessening the maintenance cost.

L. M. Denney
*President*

### Type of Drive

The motor car for railroad use should be free driven, as the direct driven motor car is not as safe to operate, particularly under load and on grades.

The free driven motor car, with friction disc and fibre friction driving wheel, seems to have given the best results with only a slight increase in the cost of the car. When pulling a heavy load with a free driven engine the ratio between the engine speed developed to the speed delivered to the car necessary to pick up the load can be altered to suit changed conditions.

The direct driven motor car, requiring the pushing of the entire load in order to start the motor, is hazardous, as the men must jump on the moving motor car after starting it. The chances of accident by the men slipping or tripping on a tie or crowding each other in their endeavor to get on the moving car is, in our opinion, too hazardous and should not be encouraged.

The free running belt driven motor cars are effective and their first cost is less; they can be used, but the belt itself is adversely affected by weather conditions.

### Economy

Let us assume that an average section is 5 miles in length and comprises 12 miles of actual trackage, not equated mileage, and sustains medium traffic. Under this class of traffic experience seems to indicate that one-half of a man per mile of all tracks composing the section, in addition to the foreman, is sufficient labor to maintain the section in proper condition. If the headquarters of the section gang are located centrally on the section, the average mileage necessarily made by the hand car per day will be 2½ miles. The average grade over which a section force will operate will be approximatelly 0.6 per cent, and in the majority of instances such a grade obtains in both directions so that the time consumed in hand car operation would be practically the same, whether the gang is considered to be going to the particular work or returning from it.

Under average weather conditions the speed obtained from a hand car with the force as stated is about six miles per hour for actual operation, or 25 min. running time per day. The time consumed in placing the hand car on and off the track, at least four times daily, is at the lowest ten minutes per day, or a total of 35 min. of time expended for which no value is received. At the end of the hand car run going to the place of the day's work, owing to the labor of pumping, at least ten minutes per man is lost in partially recuperating from the effort made in operating the hand car, totaling 45 minutes per man lost per day. Averaging 26 working days per month and 12 months per year, a loss of 45 min. per day would amount to 234 hours per man per year. Assuming the foreman's rate as 56 cents per hour, and the laborers' as 35 cents per hour, six laborers total $2.10, making a gang total expense of $2.66 per hour and a total yearly loss of $622.44.

On the same basis, if a motor car is used to transport the same section gang at an allowable speed of 15 miles per hour, the time consumed in making the run to the point of work and the return from the work, a distance of 2½ miles each day, would be 10 minutes; the time consumed in placing the motor car on the track and removing it would be the same as the average hand car, or 10 minutes per day, totalling 20 minutes per day per gang for transportation. In this method of transporting the section gang there is no energy expended by the gang en route to unfit them for engaging in their regular maintenance work immediately upon arrival at their designated point; therefore, no time is lost by the section gang recuperating from the exertion necessary in the operation of a hand car over the section. In addition, better physical condition and morale obtain.

The time consumed by hand car operation is 45 min. per man per day, whereas, the time consumed by motor car operation is 20 min. per man per day, providing a saving of 25 min. per man per day, which, at an average of 26 working days per month and 12 months per year, would amount to a saving of 130 hours per year over hand car operation in time alone; at the gang rate of $2.66 per hour, this would amount to a monetary saving of $345.80 per year.

A motor car, to fulfill the conditions we have described,

with the mileage as estimated, will show comparisons as regards costs as follows:

| | Hand Cars (First cost $60) | Motor Cars (First cost $340) |
|---|---|---|
| Depreciation, 10 per cent | $ 6.00 | $34.00 |
| Interest on investment, 6 per cent | 3.60 | 20.40 |
| Maintenance repair cost | 4.00 | 20.00 |
| Operating supplies | 2.00 | 25.00 |
| | $15.60 | $99.40 |
| Motor car cost of operation | $99.40 | |
| Hand car cost of operation | 15.60 | |
| | $83.80 | |
| Excess cost of motor car operation | $ 83.80 | |
| Minimum saving (time) of motor car operation | 345.80 | |
| Less excess cost of motor car operation | 83.80 | |
| Net saving by use of motor car | $262.00 | |
| Original cost of motor car | | $340.00 |
| Net saving by use of motor car | | 262.00 |
| Per cent earned on the investment | 77 | |

Under the hand car operation the foremen in quite a number of locations pre-empt the use of track at their convenience, protecting themselves as best they can under all conditions, being in reality in this instance outlawed occupants of a rail traffic highway. This condition is due to the slow and uncertain movement of the hand car; if block protection was afforded a hand car it would result in tieing up all traffic, more or less.

When the motor car is used for section gang transportation, on account of its assured speed when properly taken care of, rules may be formed for its operation and protection, as the chance for traffic interruptions and accidents are reduced to a minimum from this source.

On the Pennsylvania System, Pittsburgh division, the following instructions are in effect:

"M. W. Motor and Hand Cars.

M. W. motor and hand cars will be numbered for identification and designated as M. W. Motor Extra———or Hand Car Extra.

They will be in charge of a qualified employee and, except as hereby provided, all rules and special instructions governing the movement of trains will apply to the movement of motor and hand car extras.

They must not be used in automatic signal territory, unless special provision is made for manual block protection. Attention is called to the fact that M. W. motor and hand cars will not operate automatic or semi-automatic signals.

They will not be authorized to represent or run as a section of a schedule, and under manual block system rules will be operated as a 'train other than a passenger train.'

All movements will be made without displaying the signals prescribed by Rule 21.

They may be equipped with a portable telephone, in connection with the use of which they may be removed from and replaced on the main track at any point within a block by complying with the block system rules.

Maximum speed is 20 miles per hour and they must run carefully through yards and approaching road crossings."

When rules similar to the above are formulated and applied the section gang is fairly well provided for as far as operation and protection are concerned.

It has frequently been proven in practice that the substitution of motor cars for hand cars allows the lengthening of sections, thus greatly reducing the expense for supervision. On four large western railroads the replacement of 3,220 hand cars by 2,812 motor cars has yielded a computed saving of $806,993 per annum. This matter, however, is a local one and is governed by local conditions and density of traffic.

### Maintenance

On some railroads there is a maintenance of way organization under the master carpenter, which makes current inspections and running repairs to maintenance of way motor cars. The territory is divided into sections and a repairman covers each section. When heavier repairs are necessary, requiring the services of more than one repairman, the repairman on the adjacent section assists for a day or two. When a general overhauling is required the motor car is shipped to the master mechanic, where the work is done in a shop equipped with all the facilities required.

On other railroads, the master mechanic has complete charge of all maintenance of way motor car repairs, completing the running repairs on the division and the heavy repairs at his shop. This method in the first instance requires excessive riding time of the repairman, which greatly increases the maintenance cost, in addition to having the motor cars out of service a much greater time than would obtain with a well distributed maintenance of way organization.

On some railroads there is a maintenance of way shop with facilities to handle all maintenance of way repairs, including the manufacture of new track appliances. When such a shop is located where a quick supply of material can be obtained and shipping and receiving operations made rapidly, there is no doubt but that excellent results should be obtained and the motor cars maintained in service longer. The committee feels that where a maintenance of way shop, advantageously located, is not available, the master carpenter should sectionalize his territory, make running repairs on the road and have the master mechanic make all heavy repairs at the maintenance of way shop.

### Conclusions

Your committee believes that:

(A) The economical advantages derived from the use of motor cars are (1) the actual transportation time saved, (2) arrival at the point of work without fatigue, resulting in greater efficiency and increased morale.

(B) Due to the necessity of continual operation, there should be a road organization for making current motor car repairs.

Committee: J. H. Hartley (chairman), assistant division engineer, Penna., Pittsburgh, Pa.; E. C. Buhrer, supervisor, T. & O. C., Kenton, Ohio; J. F. Markert, supervisor, C. & A., Joliet, Ill., and George Holm, supervisor, B. & L. E., Butler, Pa.

### Discussion

That portion of this report relative to the design of engines aroused much discussion. Numerous members opposed the recommendation of the committee favoring the four cycle engine in comparison with the two cycle, citing satisfactory results with the latter type. Similar objection was raised to the conclusion of the committee with reference to the type of drive, with the result that these sections of the report were not adopted as the conclusions of the association, but accepted as information. The consensus of opinion was that the association was not prepared to go on record as favoring either type of engine or of drive with the information before it.

## Training the Section Foreman

By D. C. Buell

Director, Railway Educational Bureau, Omaha, Nebr.

I AM an optimist on railway conditions. I believe that we are going to work out of our present difficulties. In my railway experience and in my contact with railway men, I have come to believe that they are at their best when facing apparently insurmountable difficulties. The labor conditions of today seem to many of us such difficulties, but the fact that we are realizing the seriousness of this problem leads me to believe that we are going to work it out as successfully as we have others.

Our present problems are due to the submergence of loyalty, as a result of propaganda that has taken men's minds off of their work. All of us are human, all of us are striving to better our conditions and to provide better for our families. The fact that there has been a shrinkage of railway facilities in recent years is the explanation of the fact that there has not been that opportunity in railroading in the last few years that there has been in other industries. We have been working in an industry which has not enjoyed the expansion and which has not provided the opportunities for promotion that have been found in other lines of work.

That does not mean that we don't love railroading as much as we ever did, but it does mean that we have to bring a different viewpoint to bear on railroading in the minds of our men than was necessary to hold us in service some years ago, when our railroads were progressing by leaps and bounds and thousands of miles of new track were being constructed each year.

There is a feeling among our employees that things are not right, due in many cases to a lack of knowledge of the problems of this industry. We don't always know what the boss is thinking about. We don't always know the difficulty he has in getting sufficient appropriations to maintain his plant in proper condition. How much harder must it be for the men under us who don't know as much about conditions as we do to explain to themselves some of these seemingly impossible conditions that have existed, and in some cases still exist on our railroads.

There must be counter propaganda that will explain some of the things that are used to create dissatisfaction in the minds of the men. We must believe in our jobs ourselves before we can make the men under us love their work as they used to and respond in the efficient manner they used to because of the fact that they liked to be railroad men and are interested in their work. A man can only do good work when he likes the work he is doing.

I don't suppose that there is a man who has not at some time or other in the last few years asked himself whether his job was any good any more. I believe that every one of us loves his work. We must preach the love of the work to the men who are employed with us. We must first assure ourselves, once more, that it is worth while and instead of thinking about our troubles and wondering whether our job is any good or not, think a little about the other fellow's troubles.

We who have grown up on the railroads have taken loyalty as a matter of course. It can no longer be taken for granted. It is a problem to be worked out day by day, just the same as any other problem. It is time to stop theorizing and to get down to facts, to act on some plan, even though it may not be a perfect one. The man problem, human engineering, and that means humane engineering, too, involves the proper employment of men or the employment of proper men; fair wages; good working conditions; fair dealing; proper home surroundings and educational opportunities for the children; reasonable expectation of advancement in wages, or position, or both; and old age protection.

The educational problem can only be solved when the fundamental conditions are right. Let us have no false conception of the preliminary problem. One must build the subgrade before he can lay the track. If the subgrade has been washed out by a flood of propaganda, or is in poor condition due to neglect, it must be rebuilt before one can restore good standards. A man's mental condition must be right before he can be expected to study and he must know that such studying will benefit him as well as the company.

The educational problem is not difficult. Practical plans are available. The real problem is to surround the man with conditions that will inspire him with that love of his work and regard for his job that will urge him to give his best and strive to improve that best of today for tomorrow's work. His good work done should be openly appreciated. He should know that he is appreciated! When this is being accomplished the desire for study is born and results are accomplished.

Supervising officers must have more time for human contacts. They must have their minds free to study the men problem. They must have less inside clerical work and more outside inspirational work. How can a man lead his gang if he, in turn, is not well led? Carry home to your chiefs the thought that you realize that new conditions are before you, and that new methods must be devised to meet them.

The past decade has witnessed the greatest educational advance our country has ever experienced. Children have better school advantages than ever before. There is hardly a person in any walk of life who cannot find a means of becoming better informed on almost any subject. The foreigner can learn English in night schools, industrial workers may study the technical phases of their particular work in continuation schools, night schools or by correspondence. Newspapers, magazines and tech-

**J. P. Corcoran**
*First Vice-President*

**J. B. Martin**
*Second Vice-President*

**P. J. McAndrews**
*Secretary*

**T. F. Donahoe**
*Treasurer*

nical journals all run articles of an educational character, many times featuring this department of their publication. Labor organizations themselves run educational departments in their magazines or provide special educational service for their members.

There is little or no excuse for the ambitious man, no matter what his calling may be, lacking for information that will increase his efficiency if he truly seeks such information and has the character to devote the time to studying the information that is available. No such wonderful opportunities existed a few years ago. They are a development of the past decade or two.

While the railroads, in common with many other industries, have had systems of apprentice training in effect for years, probably the first comprehensive plan of offering education to all employees of an industry was that developed by the Educational Bureau of the Union Pacific railroad at the suggestion of E. H. Harriman. Under Mr. Harriman's plan an opportunity was offered each employee to make a systematic study of the work in his department. Interested employees were thereby enabled to increase their efficiency in their particular line of work and at the same time obtain some knowledge of the work of men in positions just ahead of them.

The advantages of this plan were mutual. The wide-awake employee had increased opportunity for advancement and promotion. He was ready for advancement when opportunity knocked on his door. The additional efficiency of employees gradually built up the efficiency of each department. The records of the bureau kept the management informed as to the individual efforts of employees. There was less difficulty in finding men fitted for promotion when such men were needed.

The maintenance of way department was one of the first to receive the special attention of the new educational bureau. Up to that time little effort had been made to provide any sort of apprenticeship for trackmen. Most foremen were equipped with only such knowledge of track work as they had been able to pick up through their practical experience.

In working out a course of study for track laborers and foremen, it was necessary to consider their educational requirements, their working conditions, opportunities for study, etc. As it was next to impossible to conduct regular classes for men so widely scattered over the system, the correspondence system of instruction was considered the most practical. In fact, this has proven to be the most practical method of instruction for railroad men in practically all departments.

The educational bureau prepared a series of instruction papers for trackmen, starting with the elements of track work and progressing to the more complicated problems of track construction and maintenance. These were followed by special instruction papers on selected subjects directly connected with track maintenance, or of special importance to track foremen—a few lessons on the elements of block signals and interlocking; one lesson devoted to gasoline track motor cars; instructions on time tables, transportation rules, maintenance of way rules and standards, section foreman's accounting for materials, time rolls, etc.

The foregoing subjects provided a practical course of study for the track laborer who wished to qualify as a section foreman. It also proved very popular with section foremen, as it gave them a systematic review of their line of work and included many practical points that the average trackman does not have opportunity to learn through the usual channel of experience.

Section foremen were encouraged to study mathematics so that they could take up the elements of surveying and mapping. Lessons on concrete construction were also available. A little technical training along these lines helped to fit the section foreman for advancement to the position of supervisor or roadmaster.

Each student received the attention of competent instructors at the bureau's headquarters. Students were requested to write a comprehensive examination on each instruction paper furnished. These examinations were mailed to the bureau, where they were carefully checked by instructors and returned to the student with such helpful corrections and suggestions as would best benefit the student. A careful record was kept of each man's progress and of the general quality of his work.

In offering this educational service to its employees, the Union Pacific officials fully realized that any progress along such lines must start with a real desire on the part of the employee for additional education. Consequently there was no suggestion of compulsory study. The opportunities of the bureau were offered to each employee, but it was optional with each individual whether or not he would attempt to profit thereby.

The work of the Union Pacific educational bureau was so successful that it was later extended to other of the Harriman lines, namely, the Illinois Central and the Central of Georgia. Since that time the bureau has been organized to serve other railroads. At present, under the name of the Railway Educational Bureau, it is serving over one hundred lines, representing over one-third of the railroad mileage of the United States. Its service is supplied to each student on a yearly subscription basis, and on terms so reasonable that every interested employee can easily afford to avail himself of its advantages.

The educational opportunities, and the consequent chance of advancement offered to trackmen on certain railroads, made it possible to attract young men of good caliber in local communities into the track gangs with the understanding that they would begin studying and be ready for promotion when their practical experience was sufficient to entitle them to consideration. The lists of studying students sent to supervising officials of different roads from time to time has brought to the attention of such officials the names of ambitious men who might be ready for promotion. It can be conservatively stated that this educational work has assisted a number of roads in their problem of the selection of section foremen.

From this early beginning many other excellent phases of educational work have grown up. Many roads have come to realize how much can be accomplished by providing an opportunity for their employees to learn more about their work and it is now customary on many roads to hold get-together meetings of trackmen from time to time to discuss current problems, to talk over the proper interpretation of new orders, to decide on standard practices. They also obtain that acquaintanceship with the men of their department and with their supervising officers that leads to the spirit of co-operation that must be present in any organization in order that it may function efficiently. The educational opportunities offered to employees have led many roads to arrange for better educational facilities for the children of their employees where the proper school facilities are not provided by the community.

Summing the matter up, it has come to be an established fact recognized by railroad officials generally that the trackman should no longer be considered a common laborer, but should be assisted in an educational way to become a skilled laborer. Labor conditions in this country have been such that it has been necessary to hire and use a great deal of rough labor on track work. Mexicans, Italians, Greeks, many of the Slavic races and even Japanese have been and are still being used in large numbers, in addition to the Negro labor of the south. It is

*A Partial View of the Track Supply Exhibit.*

by no means impractical to raise the standard of many of these classes of labor. In years past, when many Japanese were employed on track work on western railroads, the educational bureau translated its lessons on track work into Japanese with surprisingly good results in the increased efficiency of these Japanese laborers.

The Pennsylvania Railroad later followed the same plan with its Italian track laborers and furnished lessons in English and Italian that made for greater safety as well as efficiency and it also made it possible, as these men progressed in their knowledge, to promote them to foremen.

With the advent of heavier motive power, leading as it has to the necessity for much more scientific track construction, the section foreman has come to occupy a position which has hardly any analogy in industry. The section foreman today must deal with engineering work of the highest order, and still he is not a technical man. Nevertheless, there has been built up in our American railroad service a type of section foreman who through his practical training has become imbued with the sense to handle engineering matters rightly.

It is the writer's opinion that the next ten years will see another change in the track foreman's status; that he will be of necessity a better educated man; that he will have as an assistant foreman a younger man who will be training himself in a knowledge of the more technical phases of track work; and that this cycle of training of track assistants will provide the combination of practical and technical man that we are going to need in our track work in years to come.

This is going to be accomplished on some roads by school gangs made up of ambitious young men who want to follow railroad track work as a profession and who would be worked as a special gang under a competent instructing foreman so as to obtain the experience required. Evenings, in their camp cars, these men can do the necessary studying with their foremen as instructors to give them the technical information which they need as a part of their training.

Where school gangs are not provided, the right kind of an assistant foreman can study by correspondence and get much of the training that he needs in that way, particularly if given the proper encouragement by his foreman and his higher supervising officers. In order to attract the right kind of young men for such work there must be some system of apprenticeship leading to the position of assistant foreman and foreman at a rate of pay sufficient to attract these men to the possibilities of the opportunity offered.

Every intelligent trackman who expects to follow track work should be urged to become a student of track work as an expected part of his training. The old order changes. Your association has realized the necessity for new methods and new ideas in connection with track work. Why should not this association be a leader in the thought that every energy must be put forth toward creating a skilled force of track workers trained in all the principles of track work, both practical and theoretical? Then, in step with the extended use of special track tools, power machines, the further development of signal circuits, the adoption of automatic train stops, and the extension of electrified districts, men will be developing who will be fully competent to give the more skilled supervision required for the proper maintenance of such track on our American railroads.

## Methods of Making Tie Renewals

1. *SHOULD tie renewals commence at some fixed or stated period during this year? If so, when?*

Tie renewals should commence as early in the year as possible. The exact time depends solely on climatic conditions. This gives the track foreman four months in which to get all of his ties in before hot weather, for in the opinion of many trackmen, if ties are put in in hot weather the chances for buckled track are increased. The hot months can then be used for weeding, ditching, dressing ballast and other work. If any ties remain to be renewed this work can be completed in the autumn months. This holds good for any kind of ballast.

2. *What is the best method of distributing ties for renewals and when should this be done?*

The most economical method of distribution is by the work train in the late fall or winter months. Exceptions to this, however, occur when the ties are not received in sufficient quantities to warrant the use of a work train, also if the country to which the ties are to be distributed is subject to spring floods, it would not be advisable to distribute them until near the time for renewal. Ties unloaded from a work train should be piled in neat piles so as to prevent rot, permit seasoning and improve appearances along the right of way. Flat places should be selected in order to insure against their rolling down embankments, and require additional handling. Some object to distributing ties during the winter because

they do not have sufficiently large gangs to handle them properly at this time of the year. A good answer for this objection is to consolidate gangs over a district while distributing the ties within the district.

3. *Should ties be spotted in, starting at one end of the section and replacing the bad ties to the other end?*

There is a difference of opinion on this question. Ties spotted in stone or slag ballast over a whole section have been found to cost an average of 60 cents each where a regular section or extra gang is used. On many roads the spotting in method is not regarded with favor, where the drainage is not good, as it often causes sloppy track and broken rails, and it is used by them only around a curve or a joint where the end of the ties are found broken.

Where the drainage is good, ties spotted in do not disturb the track, but at best the cost per tie is more than with other methods. Ties can be spotted in in gravel or cinder ballast to good advantage. It has been found that it costs an average of 30 cents per tie to spot them in gravel or cinders. Where the track is full ballasted or light ballasted the cost averages 20 cents per tie.

4. *When ties are put in, should the track be given a general lift?*

Renewal by this method costs from 20 to 25 cents per tie in stone ballast, while in gravel the average cost is 12½ cents. Giving the track a general lift in most instances provides a better bearing for the ties and insures better riding track, affords a better opportunity for renewing anti-creepers and tie plates and provides an accurate spacing of ties. As a general practice it is a much more satisfactory method than spotting in.

5. *Should ties be put in one or two miles of track on a section each year and the balance of the section let go as to ties and general lift?*

In general, on dense traffic, stone-ballasted track, from the information obtained, the most satisfactory results are secured by giving the track a general lift over two or three miles of section each year, putting in ties and working the track thoroughly. The balance of the track is left alone as far as ties and a general lift are concerned, except for some smoothing and lining. This method establishes a cycle of three or four years and necessitates work of a character to last for three or four years.

6. *Should ties be taken out that will last approximately a year longer?*

Many railroads prefer to leave a tie that will last a year longer if this can be permitted. However, if the practice of working a third or a quarter of a section each year is followed out, it is necessary to remove the tie and, if its condition warrants, use it in a spur track or siding, since it would be necessary for the ties left in the track to last 3 or 4 more years.

7. *Where do you find it necessary to renew ties out of face?*

This occurs most frequently through private or highway road crossings where travel is heavy and where the ties are covered in any manner. The only feasible way of renewing ties under such conditions is out of face. The cost of tearing up a crossing or a platform in two or three years will be justified by the additional service obtained from the ties. Fairly good ties removed in this manner can be used to good advantage in spur tracks, yards and sidings.

8. *In spotting in ties, should the new ties be put in a spike high or tamped solid?*

Ties put in a spike high are not favored by the majority, although many agree that a tie should be put in a trifle high, but not as much as the thickness of a spike. The largest number favor tamping solid. Ties put in stone ballast give best results when tamped solid, while ties put in a spike high are not warranted or practical. The idea of putting in ties a spike high meets with greater favor in gravel or cinder ballast than in stone ballast and under many conditions proves satisfactory, although other conditions will warrant the tamping of all ties solid.

9. *In spotting in ties, should the track be given a general surface or should the low places be given attention at this time?*

If the spotting-in method is used it is hardly advisable to give the track a general surface unless it is in a serious condition. If the track is to be surfaced in connection with the putting in of ties, some other method than spotting in would be more practical.

10. *After a roadmaster sends in his estimate of ties required for curves and tangents for the succeeding year, should he be advised whether he will be furnished the number of ties to meet his requirement before deliveries are commenced?*

For economical tie renewals, it is essential that the roadmaster or supervisor be notified of the number of ties he will be furnished. If this is not done, he cannot distribute them economically, for he is required to unload ties first at his worst places, and they cannot be handled as quickly or as economically as if he knows how many ties he is to receive and can make out a distribution schedule whereby he can distribute the ties with a work train with the same operation, whether he has received his full quota or not. If the roadmaster does not receive his full quota of ties, it affects his method of renewal to a great extent, for if such a condition exists ties that will last a year or two longer may of necessity be left in the track. The failure to furnish the roadmaster's requirements may result in a temporary saving of expenditures, but it is uneconomical at best, considering the cost of the additional labor required to maintain the track under such circumstances.

## Conclusions

It is the opinion of the committee that no one method of tie renewals can be prescribed, for a method that fits one road may not fit another. The method depends on the number of tracks, density of traffic, kind of ballast, price of labor, financial condition of the railroad, roadbed and drainage conditions, condition of the track, and the topographic and climatic conditions of the country through which the railroad runs. The above is the consensus of opinion obtained from the answers of 26 roadmasters and supervisors over the country to a questionnaire submitted by the committee.

Committee: J. P. Davis (chairman), roadmaster, Central Indiana, Anderson, Ind.; A. M. Clough, supervisor, N. Y. C., Batavia, N. Y.; C. H. Royer, supervisor, B. & O., Newark, Ohio; C. E. Miller, supervisor, Penna, Titusville, Pa.; W. H. Sparks, general inspector of track, C. & O., Russel, Ky.; W. H. Saltsman, supervisor, Penna., Ravenna, Ohio.

## Discussion

Some discussion developed regarding the proper time of the year to distribute and renew ties. J. P. Davis, chairman, summed up the committee's belief on this point by stating that ties should be put in as early in the spring as possible in order to get this work out of the way before hot weather. In this R. G. Knight (N. P.) concurred, adding that there was a material disadvantage in making tie renewals in the hot summer months since the ballast becomes baked and therefore harder to work and because of that and the weather it is not possible to secure as much work from the forces. Therefore the cost per tie for renewals is greater than it would be if the work was carried out under more favorable conditions. J. P. Corcoran (C. & A.) favored the idea of distributing ties

in the winter months and thus getting them out to the section forces between December and March. The establishment of such a plan prevents late distribution in the spring and permits the section forces to get to work at once in the spring, resulting in economy in cost. In many cases local trains or way freights can be used when work trains were not available. With such a distribution the ties would be available and many renewals could be made when rough track was being surfaced.

There are other factors connected with distribution aside from the desire to have the ties on the ground for the section forces. Along this line of thought, T. Thompson (A. T. & S. F.) said that there are times when cars can be secured and shipments made and times when purchasing can be done most economically. In many instances the ties can be piled at the stations along the line and permitted to season, the section foreman taking out small numbers at various times as he is carrying on his other work until all are distributed eventually to the locations where they are needed. W. Shea (C. M. & St. P.) opposed the distributing of ties in the winter because of the natural tendency of the foreman to put them in the track convenient to where they are unloaded. He maintained, regardless of their type and class, that no ties should be distributed to the section forces after the close of the tie renewal work one season until the opening up of the work in the following spring. The ties should be unloaded and piled at designated points as received, either from a treating plant or from other sources, and then classified and assorted as they are piled, distinction being made between hewed and sawed, treated and untreated and different woods. On the St. Paul, the section foreman makes an actual count (and marks the rail) of every tie which should be renewed. This count is checked in the field by the roadmaster and the division engineer, who are thus able to determine and send out the proper classes of ties for renewal to the exact points where they are needed. It is a failing, but nevertheless a fact, he added, that where ties are piled along the track on a section, the foreman will make his renewals in the spring from the pile which is nearest, as a result of which ties suitable only for tangents may be put in curves and excellent ties for curves put in tangents. Further than that, once the ties are unloaded along the track, they are virtually, if not actually, out of the roadmaster's control. In opposition to this plan, Chairman Davis stated that it meant additional handling and that every time a tie was handled it cost money, and in the end, a surprisingly large amount.

In discussing the relative economy of renewing ties out of face or by spotting, J. B. Martin (N. Y. C.) said that where stone ballast is used the most economical method is to raise the track out of face, making such a raise every two years and renewing the ties when this is done. This was not necessary in gravel ballast, although it can be done occasionally to advantage. Since the use of treated ties the renewals had been gradually dropping off and it is possible to allow the track to go over one year without renewals.

The section of the report dealing with a recommended cycle of renewals running over a period of three to four years came up for considerable criticism, since it inferred that ties would be renewed where there was perhaps one or two years additional life to be secured. In this respect H. R. Clark (C. B. & Q.) pointed out the importance in making such a recommendation, of defining the class of track to which it was applicable. It was quite possible that such a plan might be of value to certain classes of railways but he thought that such roads constituted only a small proportion of the whole. In general it could not be considered good or economical practice to take out ties that would last for several years more. T. F. Donahoe (B. & O.) stated that the problem resolved itself into a question of comparative costs based on the average annual cost per tie per year. When renewing out of face he thought that there were many times when it would be more economical to renew ties even where two additional years of life were left in the tie. J. W. Dahl (N. Y. C.) said that in 30 years' experience with stone ballast he had never seen a good tie which had been dug in. In spite of all precautions it was not possible to tamp it so thoroughly that it did not work up and down, causing additional wear on the adjoining ties. In a short time there were three bad ties where there had only been one before. So far as light lifts were concerned the gradual settlement of the track each year compensated for the raise given. Along the same line I. B. Martin (N. Y. C.) remarked that he had raised his track a total of five times in 11 years with lifts of from one to one and one-half inches and that in that time it had only been necessary to shim the bridges once. R. G. Knight (N. P.) emphasized the desirability of giving consideration to the depletion of the timber supply and pointed out the duty of everyone to get the longest life possible out of his ties.

## Section Gangs vs. Extra Gangs

IN THE maintenance of railroad tracks, roadbed and right-of-way, exclusive of the bridges and buildings, there are two entirely different systems for the organization of forces for the conduct of the work. One method is to maintain small regularly assigned section forces of only sufficient size to do the light work necessary to keep the tracks in proper and safe running condition. This work includes track watching and inspection, bolt tightening, ordinary gage, surface, cross level and track alinement maintenance, switch inspection and adjustment, etc. All replacement and betterment work such as tie, ballast and rail renewals is taken care of by larger floating forces or extra gangs, housed in movable camp cars so that they may be kept in close proximity to their work.

The other maintenance system is to take care of all work with the regularly assigned section forces and seldom if ever employ the larger extra or floating gangs. This necessitates much larger section forces than the first method, but has the advantage of making each supervisory foreman responsible for the continued maintenance of all work done on his section, which it is thought results in better work, more carefully done. Between these two extremes lay all track maintenance organizations.

The purpose of this report is to suggest and recommend a compromise between the two systems best and most economically suited to the track maintenance conditions of the average American railroad. We think that all regular routine track maintenance work such as detailed gage, line, surface and cross level maintenance, ordinary track drainage, and tie renewals should be taken care of by regularly assigned section forces. They should be equipped with modern tools, in good condition and in sufficient quantity, and have suitable motor cars to conserve the time and physical strength of the men for useful work. The forces should be maintained at as nearly as possible uniform strength throughout the year, with slight seasonal additions during the heavy working season from April to November in the average American climate. This makes possible and encourages the employment of a better and more skilled class of labor than the great seasonal force variations sometimes practiced, where a bare skeleton organization is maintained through the winter, and a large number of

extra, and usually floating and poor quality laborers are added during the summer. Nothing is more important in track work than satisfied, experienced and regular workmen.

The heavy track replacement work such as continuous rail renewals, and heavy ballasting out of face should be taken care of by specially organized forces, housed in movable camp outfits. Extensive fence building or rebuilding and cut or bank widening can also best be taken care of by special forces. Such special forces become skilled in their work and reduce unit costs to a minimum. They should be required to leave their work in a completed condition, and not leave parts of it to be completed by section forces.

Between these classes of usual routine maintenance work and special heavy maintenance work, which should be taken care of by regular section forces and special extra gang forces, respectively, there are some kinds of special work of a lighter nature which can be handled economically by increasing the size of and, if necessary, doubling up the regular section forces. Such work includes scattered rail patching, curve worn rail renewals in short patches, and ballast cleaning and patching or light resurfacing in short stretches. No heavy ditching should be done by hand, as one of the several good mechanical ditchers on the market, handled by a work train and attended by regular section forces, with a few extra men, will take care of almost any ditching condition economically.

Frequently section and extra gang forces can be worked together advantageously where a large number of men are needed for a short period, but cannot be worked continuously to advantage. On one road extra and section forces are combined for rail renewals. The regular rail extra gang makes necessary prelimilary preparations for renewing a stretch of rail, then the track is taken for a day and the rail gang, with the assistance of section forces brought in from 15 miles in either direction, will relay this section of track, while the trains are being handled over another track. A large number of skilled track men can thus be gotten together for a short period, and it is found that the men, working harmoniously under the roadmaster and his assistant, will do the work much more cheaply than it can be done by large extra forces working under traffic, and with much less resultant delay to heavy freight traffic. After the rail is laid, the extra gang completes the work of cutting the old rail apart, loading it up, renewing ties and switch timbers under new rail as may be necessary, and other work incident to completing the job.

The same practice of doubling section forces for a short period may be followed advantageously in making short patches of curve rail renewals, or surfacing short stretches of track out of face where the work is too heavy to be handled by one average section force, but not great enough in extent to justify the moving in of an extra gang.

Often local conditions largely effect the working program. Where there is a good supply of local labor in a section where heavy track work is to be done, it can frequently be done advantageously by promoting the local section foreman to an extra gang foreman and appointing another man to take charge of the section and look after the routine details of the section so he will not have to divide his attention between the heavy work and the regular routine work.

Ordinarily maintenance should be kept up currently so that the necessity of organizing large extra forces for heavy seasonal work may be reduced to a minimum. This can be done where reasonable section forces are maintained throughout the year. Routine fence repair work, for instance, can best be done by regular section forces in the late fall and winter when the undergrowth is down, eliminating the necessity for special fence repair forces in the summer. The same is true of rail patching, drainage improvement, pipe replacements, etc.

In short, track work should be so handled as to reduce to a minimum the growth of conditions requiring unusual and heavy seasonable repair work, but when such conditions do exist from betterment necessities or unpreventable causes, the heavy work should be done by special extra forces and not by doubling large section forces for any length of time, and taking men away for long periods from the maintenance of the special territories to which they are assigned.

Committee: R. H. Smith (chairman), assistant division superintendent, N. & W., Roanoke, Va.; I. D. Talmadge, roadmaster, N. Y. O. & W., Middletown, N. Y.; George Kohn, roadmaster, C. R. I. & P., Joliet, Ill., and J. A. Roland, roadmaster, C. & N. W., Missouri Valley, Iowa

### Discussion

The part of the report dealing with the recommendation regarding modern tools and motor cars created considerable discussion because of the belief that the report recommended the lengthening of sections. W. F. Muff (A. T. & S. F.) opposed the association going on record to the effect that sections should be lengthened if motor cars were used. Under the conditions now existing maintenance forces were being called upon to do more and more tasks which had not been included in their work heretofore and any saving in time by the use of motor cars was being utilized in the performance of these other tasks. In support of the committee's statement R. H. Smith (N. & W.), chairman, stated that where motor cars were not now in regular use, a real business reason had to be submitted to influence their purchase. Longer sections could be maintained economically with their use and he believed that if a section force which had been given a motor car and a slightly longer section was offered the opportunity to go back to the prevous system, it would probably refuse it. It was the thought of W. Shea (C. M. & St. P.) that the size of the motor car regulated the length of the section automatically. The average motor car cannot handle efficiently more than seven men and a foreman and their tools. Thus the length of the section in this case is what seven men can handle economically.

The greater part of the discussion dealt with the question of where section gangs and extra gangs could be used to the best advantage. P. J. McAndrews (C. & N. W.) placed particular importance on this subject at this time for the railways were now facing a critical labor situation. He deprecated the practice of the railways in laying off their maintenance forces at the first sign of frost in the fall. If the men are not held through this winter the railways will not be able to get them next spring. In the average climate forces can be maintained, he thought, at a fairly even average for the entire year.

If increased efficiency is to be obtained by increasing the section forces there is one factor, according to T. Thompson (A .T. & S. F.), which must be considered and that is that only about 50 per cent of the section foremen are capable of working a large body of men on construction work efficiently. If this plan is carried out on a railway, such a section foreman must have an assistant to handle many of the routine section matters, in which case, there would probably be a loss of time and a consequent loss of money. The ordinary renewals should be handled by a section gang and the heavier work by an extra gang.

Another phase of this question hinges on the labor

situation. This was brought out by J. B. Martin (N. Y. C.) who said that all of the work cannot be done by section forces because it is not always possible to get enough men locally and to keep them. Section work is local work and the available supply is thus a controlling factor. At the present time is requires a gang of from 65 to 70 men to lay rail and if adjoining section forces are consolidated it will require about one-half of a roadmaster's section forces to perform this work alone. Laying rail and heavy tie renewals necessitate well organized forces.

F. H. Hansen (G. N.) pointed out that extra gangs are an absolute necessity on some roads if any work is to be performed at all since the winter conditions, such as are encountered in some of the northern states, are so severe that practically all possibility of working them is shut off and only routine work is possible. If section forces perform the work better than extra gangs he maintained that the roadmaster was at fault and not the forces.

The big advantage of working section forces and extra gangs together was, as Mr. Smith stated, that it secured an increased output. In addition the bringing of section men into an extra gang has a beneficial effect on the remainder of the force and helps to balance them. It is not good practice to keep the section forces away from their section as a regular practice and therefore they should only be brought in to help when skilled work is actually required. The extra gang should do the preparatory work and the finishing and cleaning up.

## Non-Spacing of Joint Ties and Non-Slotting of Joints

AT THE PRESENT time all railroad managements are calling for less expensively maintained tracks, and at the same time for an improvement in the track structure. We, the actual users of the materials and labor, are expected to maintain the tracks at a lower cost. We believe that the "non-spacing of joint ties and the non-slotting of joints" offer one of the best methods of complying with these requirements.

It is a known fact that the joint is the weakest point in railroad track. Every conceivable means has been applied to reinforce and strengthen it to make it equal in strength to the rail, but nothing that has yet been developed approaches this objective. Why, therefore, should we place an extra burden upon the joint by making it render service over and above the other portions of the rail by anchoring the track at this weak point by slotting the angle bars and spiking through the slots, which action causes the rail to drag the ties off their bed as it runs. When the ties are shifted in this manner they are lowered and cavities are created back of them in which water accumulates and causes the joints to churn, become low and battered, destroys the bolts and angle bars, and bends the rail in the short quarters if it is allowed to creep to any extent.

With non-slotted angle bars and with rail anchors placed on the intermediate portions of the rail, the joints are permitted to pass over the ties without disturbing them if the rail should creep, thereby eliminating the slewing of the ties and creating no cavities in which the water may accumulate about the joints any more than about any other tie under the rail. This preserves the angle bar and protects the bolts, which can be kept tight because of the absence of extra stress.

All ties should be spaced uniformly under the rail regardless of their position relative to the joint. In other words, one joint may be a suspended joint and the next one a supported joint, distributing the load upon the ballast and the roadbed uniformly. When laying new rail, where it is not the intention to space the ties under the joints, they should be staggered so that they will come at the centers of the old rail. If the new rail is the same length as the old rail this can be done, and it will promote good riding track.

The number of rail anchors required to hold rail from creeping depends on the volume of the tonnage carried, the kind of ballast, the condition of the roadbed and the grades. Ordinarily from 6 to 8 rail anchors are sufficient to hold rail from creeping under one-way traffic, except where trains slow down or stop at stations, at which points more anchors will be necessary. Where the track is carried on peat bog or wet, unstable ground from 8 to 12 anchors may be required. On single track 2 to 4 anchors are required, these anchors being applied each way except on descending grades, where the rail usually moves in one direction, in which case all of the anchors should be applied the way the rail is creeping.

To space ties uniformly under the joints and elsewhere throughout the length of the rail where the track is given a three-inch raise, pack tamped, will cost $840 per mile in stone ballast, while to give it a three-inch raise in stone ballast where ties are not spaced will cost only $690 per mile, a saving of $150 per mile by not spacing ties. To space ties uniformly throughout the length of the rail in gravel ballast where the track is given a three-inch raise, shovel tamped, will cost $700 per mile and where the ties are not spaced $570 per mile, a saving of $130 per mile by not spacing ties. These figures are based on $0.40 per hour for labor.

It will cost $0.80 per joint to space the joint ties and shift the shoulder ties where necessary in stone ballast and $0.50 per joint in gravel ballast. This is poor practice and should not be allowed on any railroad for the reason that the ties are moved off their old bed and will not be as solid as the other ties under the rail, causing the joints to become low, bend the angle bars and make bad riding track.

The saving of tie timber is also an item well worth considering. In spacing ties more or less damage is done them, which hastens the time of their removal. In spacing ties some of them are necessarily moved off their old bed, while others are not disturbed, which gives them an unequal bearing, however well they may be tamped, and requires more frequent surfacing to maintain the track at a true level.

The eliminating of the spacing can be done with the greatest safety where the track is in good line and surface. Where this condition prevails the spending of any money for the spacing of ties is largely a waste in so far as any improvement in the track maintenance is concerned.

When rail is being relaid where the track is in bad line and surface and the rail badly surface bent so that it is necessary to surface the track under the new rail immediately to prevent damage to it, the surfacing can be carried on much more rapidly if no time has to be spent on the spacing of ties.

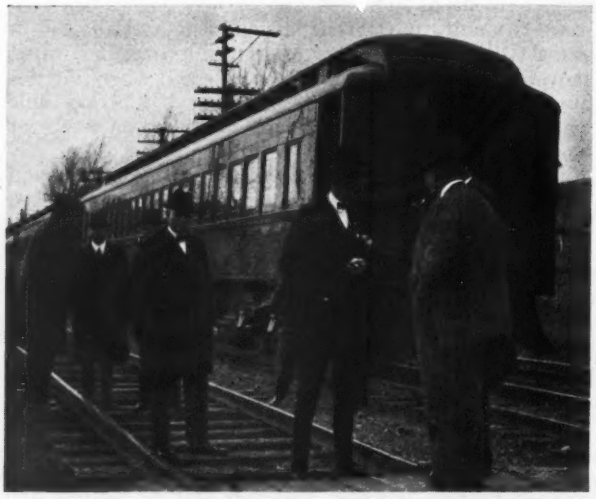
Committee: F. L. McMillan (chairman), roadmaster, C. & A., Bloomington, Ill.; E. J. Boland, roadmaster, I. C., Freeport, Ill.; W. F. Lavin, supervisor, P. & L. E., Pittsburgh, Pa.; P. M. Dinan, supervisor, L. V., Geneva, N. Y.; L. Coffell, supervisor, C. & E. I., Momence, Ill.; W. E. Haberlaw, roadmaster, C R. I. & P., Bureau, Ill.

### Discussion

This report gave rise to very active discussion and indicated the wide divergence of opinion regarding these practices. In commenting on the statement of the committee to the effect that the joint is the weakest part of the track C. W. Baldridge (A. T. & S. F.) stated that tests made by the American Railway Engineers Associa-

tion showed that some joints now in use are as strong as the rail with respect to downward loads, but the real problem is to secure this strength against loads applied upward. As a load comes on a rail, an upward thrust is developed in the opposite end which must be resisted by the joint, the joint ties acting as a fulcrum. The chief objection to the non-spacing of joint ties is, in his opinion, the unequal lever arms which may exist under the joint. He described a test which was made on 50 miles of track on the Santa Fe in New Mexico where the ties were not spaced when the rail was laid in 1918. A recent inspection showed that this rail was in much worse condition than other rail laid at the same time under similar conditions (except for the tie spacing), and that broken joints were more numerous. C. J. Coon (N. Y. C.) and T. Thompson (A. T. & S. F.) advocated using enough rail anchors to prevent the rail from creeping and when this has been done, to eliminate the spacing of ties as unnecessary and a decided waste of time, of ties and of ballast.

W. Shea (C. M. & St. P.) stated that for 10 years it had been the practice of the St. Paul to lay rail on



**Inspecting Track on the Terminals on Thursday Afternoon**

main lines without slot spiking the joint ties, and that they would not consider any change. If the track is to be ballasted at the time rail is laid, the ties are spaced, otherwise they are not disturbed. W. F. Nichols (L. V.) stated that for 10 years after doing away with the spacing of ties when laying rail, the results have been so satisfactory that they would not consider returning to the old practice. P. J. McAndrews (C. & N. W.) said that the Northwestern had been experimenting along this line and a track laid in 1916 in which the ties had not been spaced or the joints slot spiked had required less maintenance. He was decidedly in favor of not-slotting the joints.

C. H. Gruver (C. R I. & P.) stated that the subject could not be treated rightly unless rail anchors were mentioned along with it. Although the slot spiking of joints was admittedly bad practice it was a help in preventing rail creeping when an insufficient number of rail anchors were used. Many railway men are spacing joint ties and spiking slots that do not approve of that practice. A. M. Clough (N. Y. C.) called attention to the fact that no matter how well a joint was made and installed it was still a joint and would always need special atttention.

J. W. Powers (N. Y. C.) advocated the spacing of ties. The high speeds, increased weight of locomotives and cars, and the heavier traffic, demand more rigid and permanent track construction and there is no part of the roadway that should receive more careful attention than the joint. He contended that it was necessary to move all ties on new rails at some time to attain uniform spacing and that there was little or no saving from the elimination of this spacing when the rail was laid. He urged that the track be given a light lift after new rail is laid to facilitate the renewal and respacing of ties and securing a better surface.

At the conclusion of the discussion, the association voted in favor of the elimination of the spacing of joint ties and the slotting of the joints.

## Labor-Saving Devices

THE shortage of labor in railroad work during the last few years had led the railroads to substitute machanical devices for labor in an effort not only to reduce the cost of the work, but also to get a larger percentage of it done during the season. Little money is saved by the use of some mechanical devices, but the fact that less labor is needed (at times of shortage) makes the use of these devices worth while, as it enables the roads to get work done which would be impossible otherwise.

When machinery is used it must be utilized in an efficient manner and the organization should be instructed thoroughly as to the part each man or small group of men is to perform in order that the work may progress efficiently. All concerned, division engineers, roadmasters, foremen and laborers, should co-operate in giving the device close study and understanding its possibilities. Even after a labor-saving device has been established in service, after having gone through severe tests and the equipment is considered standard, it does not necessarily mean that success will always continue to any marked degree unless the machine is handled properly, kept in regular repair and operated correctly.

### Rail-Laying Machines

Labor-saving devices are being utilized more and more to speed up the renewing of rail and a great deal is saved by their use. Where long stretches of rail are to be renewed, locomotive cranes are coming into use to replace the tong gangs. On account of the increasing weight of the rail its handling by hand is a costly operation and where a derrick can be procured that will move under its own power a great deal can be saved. If there are men enough available it is advisable to use two cranes, one to lay the line side and the other to follow laying the gage side. The cranes can be followed up by pneumatic bolt tighteners, pneumatic air drills and pneumatic machines to take off old bolts, the pneumatic tools securing their air from signal pipe lines, if they are available and have sufficient excess pressure, or where they are not used, from a tamping machine compressor.

In laying rail with equipment of this kind it is necessary to arrange for the exclusive use of the track until the work is completed and for the mechanical equipment to be brought to the nearest siding or yard prior to the beginning of the work.

In order to operate these machines economically there should be men enough to keep the work going as fast as the machines will operate. The force to lay the rail on one side should include at least 125 men with 1 locomotive crane, 6 pneumatic bolt runners, 4 pneumatic air drills and 2 rail-loading machines, the latter in a work train picking up the old rail, angle bars, scrap, etc. By using section gangs better supervision of each unit of

work is secured, as each group of men will work under its own foreman.

The cost of renewing rail by the use of machines, based on using 2 cranes, 4 portable air compressors running 8 pneumatic machines, a work train with 4 double end rail-loaders and 262 laborers and 26 foremen or assistant foremen was as follows:

| | Per Ton | Per Mile |
|---|---|---|
| Unloading 3,161.5 tons of new 107-lb. rail | $0.49 | $82.39 |
| Distributing angle bars, tie-plates, spike and other accessories | .34 | 57.17 |
| Scoring ties and other preliminary work | .22 | 36.99 |
| Taking out old 100-lb. rail and renewing with new 107-lb. rail, including picking up old rail and scrap | 3.29 | 533.18 |
| | $4.34 | $729.73 |

The above included the cost of installing new tie-plates and rail anti-creepers, but did not include the renewing of turnouts which were jumped and renewed later with a smaller gang. This work, as done in the past by hand and including the cost of closing in for trains, would aggregate approximately $12 per ton or $2,000 per mile.

The committee feels that on account of the lack of labor and the increased rates now paid for it the roads should give over the entire use of a track on railroads with two or more tracks when renewing rail, for if the track is not given up the machines will not save any money, but will increase the cost because of the delays in getting the equipment into the clear of trains.

Where only a few men are available the three-man track layer is a valuable asset, especially in laying rail in yards. While the machine is called a three-man track layer we find that the work is done more economically with five or six men and a saving of approximately $300 per year for each machine in use can be made, based on the fact that these machines with 5 men will do the work of 15 men and assuming that they are used about 2 hours per day, for 60 days in the year. This saving can, of course, be exceeded by the more frequent use of the machine.

### Rail Unloaders

At the present time we are unable to handle rail in any quantity by hand and it is necessary to use bridge and building derricks on some roads in order to make any headway. These derricks are not designed for quick operation and require an engineer and fireman to operate them, whereas the rail unloaders are especially designed for this work and can be operated quickly by the foreman or an experienced laborer.

With the increased weights of rails, frogs and switches, the necessity for these machines becomes more pronounced. The saving in time in handling and reshipping rail will enable more work to be done in a season. The machines are operated by compressed air taken from the train line and, like other labor-saving devices, can be put to other uses, such as handling heavy signal and bridge materials and scrap. If a large amount of rail is to be unloaded it will pay to use two or more machines in one train so as to save switching after completing the unloading of two cars while still holding the main track. By using two machines in a train, 16 men, a foreman and an assistant foreman, can unload rails from cars at the rate of five or six a minute, providing the locomotive is equipped with a pump to furnish sufficient air pressure.

### Cleaning Ballast with Locomotive Cranes and Screens in Cars

The utilization of locomotive cranes in connection with screens in cars for the cleaning of ballast has proved that much can be saved in this way. In using these cranes a better job of cleaning is done, because when cleaning with laborers the bottom of the tie is about the limit, while with the locomotive cranes the strip between tracks on multiple track territory is dug down to sub-grade. This stone goes over the screen and all dirt is removed, leaving clean stone of the depth of the ballast for drainage. The expense of the work will be reduced by using two or more locomotive cranes.

The screen is placed on a car built for the purpose or can be built for use with any standard steel hopper bottom coal car, so that the stone goes over the screen in one pocket, while the dirt falls in the other, the stone pocket being left open and the stone falling on the track. The dirt can be disposed of on sidings or elsewhere. The cost of doing this work varies, depending upon the location, the train service and closeness to clearing points. On one railroad the following was found to be the cost, based on cleaning 25 rail lengths per day:

| | |
|---|---|
| 1 engine and crew 10 hours | $ 85.00 |
| 2 locomotive crane engineers | 10.80 |
| 2 locomotive crane firemen | 6.40 |
| 8 laborers (4 per machine) | 25.60 |
| 15 laborers digging out between ties (2 rails per man) | 48.00 |
| Total | $165.08 |

Cost per rail length, $6.60.

This cost, compared with $9 per rail length by hand and work train, shows a considerable saving. On another railroad the cost amounted to $3.17 per rail by utilization of the locomotive crane, screens in cars and work train, where the ballast was cleaned to a depth of 20 in. from the top of tie.

### Snow-Melting Devices

There are several devices for handling snow. One method is the use of hydro-carbon for melting snow at switches. The cost of cleaning switches by hand will average 55 cents per switch at interlocking points as compared with 20 cents per switch by the use of hydro-carbon. Steam heating plants are being used at terminals where steam can be piped conveniently or furnished from old locomotive boilers placed at important points and covered so that they make a desirable appearance. A steam heating plant properly operated can be run with three laborers and a foreman, whereas it will take 25 men, a foreman and an assistant foreman to keep such a place open during a severe storm. This means a saving of approximately 60 per cent.

### Motor Cars

It is a well-known fact that the motor car is a great labor-saving device, especially on single track sections where the territory is long. The general use of motor cars has helped materially during the past few years in holding labor, as there has been less difficulty in holding men on sections so equipped than on sections not so equipped in the same territory. As a separate report will be presented on this subject it is unnecessary to refer further to motor cars here.

### Tamping Machines

Tamping machines are standard on many roads today. The committee finds that some roads show great savings by the use of these machines, while investigation shows the cost of tamping ties with these machines to be little less than the cost of tamping by hand, but the work done with these machines will hold up twice as long or more under favorable conditions. The amount of labor required to tamp a given length of track is about one-half that required to tamp by hand, but the cost of fuel and operation of the machines absorbs part of this saving. The cost of tamping by hand, including lining and dressing,

will average 20 cents per tie. As track tamped by machine will hold up twice as long, one tamping is saved.

In locations where an air line exists these machines are particularly valuable. The compressors are a valuable asset when used for other purposes, such as running pneumatic drills, reamers, riveting machines, sand blasting and painting machines, pneumatic machines for bolting and unbolting rail joints, etc. They are also valuable in emergencies for operating signal lines, charging train lines, pumping water, etc.

### Ditching Machines

The steam ditcher is one of the greatest labor-saving devices where heavy ditching is to be done. With an air dump car placed on each side in a work train, it will accomplish as much in one day as 30 men will do with flat cars in 3 days. It is also being applied more and more to other uses, such as handling rail, ties and other materials, and is available in emergencies for loading coal at storage piles and for use at engine terminals in the winter. This machine has an advantage over steam shovels in sand pits and coal storage piles in that it does not require the service of a work train, for it is able to handle from 2 to 3 loaded cars under its own power, or to operate under its own power on a track parallel to one on which empty cars may be set. It can also be used for the purpose of removing drifts or ice gorges from trestles or bridges by disconnecting the clam shell or shovel and attaching a pair of car wheels on the axle to the end of the cable and dropping it on to the ice so that it can be removed in small quantities without any trouble after being broken. By breaking the ice gradually in this manner it can be handled easily.

We find that the cost of handling coal, sand, etc., averages 10 cents per cubic yard, whereas the cost of handling this same material by hand will average 60 cents per cubic yard. This was based on one machine handling 25,000 cu. yd. of material in one season.

### Spreaders

A spreader, when used with a work train, has performed the work of at least 20 men in disposing of material on a fill and in ditching light cuts. This, on the basis of 150 working days, would be a saving of about $9,600 in the course of a year.

### Dump Cars

Side dump cars are of great assistance for the wasting of material or the widening of fills. The type equipped with an iron apron which lets down will deposit the dirt or material to be wasted beyond the ballast or grass line. Many roads are using the steel-lined, 20-yd. yard dump cars for handling cinders and ashes from engine terminals. To unload cinders from old side board cars by hand, as has been the custom for years, costs approximately 50 cents per yard, while these materials can be unloaded from dump cars for about 10 cents per yard. This will effect a large saving in the course of a year.

### Weed Killers

The use of weed killers should be extended and two applications be made a season, one the latter part of May or early in June and the other in September, as it is found that one application is not sufficient to sterilize the soil completely. The cost of treatment, including work train service, is approximately $32 per mile, which would make the cost of two treatments per season $64 per mile. It would be impossible to perform this work as economically by hand labor as by the application of weed killer, and in addition it represents a large saving in labor.

Oiling appliances save a great deal of labor in oiling the roadbed and grade crossings. There are also attachments for these devices that can be used to oil track bolts and fastenings, thereby saving a great deal by arresting the deterioration of same.

Committee: George W. Morrow (chairman), supervisor, N. Y. N. H. & H., New Haven, Conn.; J. W. Powers, supervisor, N. Y. C., Rochester, N. Y.; J. M. Fair, supervisor, Penna., Philadelphia, Pa., and C. A. Joyce, supervisor, Erie, Paterson, N. J.

### Discussion

It was apparent from the trend of the discussion on this subject that a large number of those present realized that conditions at the present time and to come in the near future, were such as to call for the increased use of mechanical equipment. The importance of the subject was particularly emphasized by W. Shea (C. M. & St. P.) who said that it was the duty of every roadmaster to get behind mechanical devices and strive for their adoption and successful use. There are many tools that can take the place of labor, but many men had never even seen some of these appliances in use, let alone using them themselves. They should encourage their use at every opportunity.

S. E. Shoup (K. C. S.) urged the roadmasters to endeavor to bring to the attention of their superiors the advantages of the various classes of equipment which had impressed them as being particularly valuable and applicable. The use of more labor-saving devices is sure to come and it is up to the roadmaster to do everything possible to make their application advantageous to the road. C. J. Coon (N. Y. C.) emphasized the value of any practical form of labor saving devices for use in industrial centers and in terminals, etc., where labor is hard to get and still harder to hold. As an example, he cited snow melters, stating that one laborer can keep as many switches open by means of an efficient snow melter as ten men can by hand. He described how a small portable grinder for removing the burrs on the stock rail at switch points could be used to increase switch life.

C. W. Baldridge (A. T. & S. F.) mentioned a gasoline operated derrick which the Santa Fe was using successfully for laying rail. C. H. Gruver (C. R. I. & P.) stated that this machine had done good work while he had it in charge, but the operating department placed a conductor and brakeman on the unit and this added expense made it impossible for him to do the work as economically as it could be done with the smaller, hand-operated rail layer. W. F. Muff (A. T. & S. F.) stated that he had laid as many as 100 rails in an hour with it at times.

H. R. Clarke (C. B. & Q.) referred to the fact that very often when a new machine is introduced on a railroad the men condemn it off-hand. This is unfair to the men, the machine and the railway company. Everyone must co-operate in giving labor-saving equipment close study for the railways must save money. He called attention to the fact that practically every type of equipment mentioned in the report showed a decided saving in costs.

C. W. Baldridge, in commenting upon the statement in the report regarding the cost of tamping ties, said that in an investigation made for the American Railway Engineering Association, machine tamping was shown to have a decided advantage over hand tamping. In no case did the machine work cost more and in all but one case it was less than that for hand work. He urged that every roadmaster take an active interest and in no case allow prejudice to sway the result. He mentioned an instance where it was decided to concentrate on one make of motor car over four operating districts. One district fought the change and that district never secured any results from the motor car which was being tried out.

An adjoining district had the opposite experience and the reports from that district indicated that the car was entirely satisfactory. As a result of the conflicting data many section forces continued to pump hand cars for a considerable time, because the districts could not get together.

## The Essentials of Morale

By S. E. Shoup,
Engineering Assistant to General Manager, Kansas City Southern, Kansas City, Mo.

THE TERM "MORALE" has only lately been applied to industrial conditions. Until the outbreak of the great war, it was confined to military usage. In the military sense the meaning of the word had long been clear. When it was said the morale of an army was good, it meant that the army believed in the principles for which it was fighting, that it had confidence and respect for its officers, that it was mindful of and submissive to discipline, that it bore lightly or even enjoyed necessary hardships and that it had determination and will to win.

The word "morale" applied to industrial groups must necessarily undergo some modification. Industrial work does not offer the glamour, romance, glory or the defense of sacred principles to spur men on and lift them to an idealistic plane. The humdrum routine of industrial work neither teaches nor begets nothing of self-abnegation for high principle or just cause. On the contrary, individual or class selfishness is accentuated. Therefore, to adapt the word "morale" to industrial conditions, some modification in its definition is necessary. Several definitions have been advanced, none of which seem wholly adequate. Let us then define industrial "morale" as the wholesome outlook of a body of men on their working conditions, their superiors and the company which employs them, and accept this definition tentatively as a working hypothesis for discussion.

The "morale" of a body of men is somewhat analogous to the personality of an individual. Personality embraces the body, mind and soul of the individual; it is the person. So, in a group of men, their morale is the composite of their physical beings, the composite of their minds and the composite of their souls. It will therefore be appreciated that "mob psychology," that study full of paradoxes and contradictions, most of which evaporate upon careful analysis, is the key to the building up of morale. Some study of this subject is earnestly commended to anyone in a supervisory position, and the time and effort given it will be well repaid. We will now turn to a brief discussion and analysis of some of the important conditions and practices that tend to weaken or destroy morale and follow the phase of the subject with a similar discussion of conditions and practices which build up and strengthen morale.

### Practices Which Destroy Morale

Favoritism of certain kinds will inevitably weaken if not wholly destroy morale. If a man is favored because of superior energy, because of dependability or because of greater knowledge, there is no resultant weakening of morale. Favoritism of this kind may even strengthen morale and spur individual effort. The good man usually gets the hard job and the consequence should justly be recognition and promotion. The favoritism that is objectionable and which will ultimately play havoc is where one man is given all of the easy assignments for no other reason than that he is liked by his foreman or superior. This is frequently found, and the effect upon other men who work hard and are not given the equivalent personal consideration and concessions they deserve is disastrous.

There is a certain type of man who can never build up a loyal or effective force. This type is conspicuously conscious of his own importance and authority. Each one of you knows the type and has probably worked under a man of this kind. He is disliked by his subordinates and associates and is usually disgustingly obsequious in the presence of his own superior. It is his delight to humiliate and belittle his men by an offensive display and exercise of his authority. He never accords the benefit of the doubt and is never satisfied with any performance. He is a constant critic and can with unerring accuracy tell how resulting consequences could have been avoided after they materialize. This type of man is usually the one who, in the words of Julius Krutschnitt, cannot grant a favor without adding an insult thereto. This type is temperamentally unfit to be in charge of men, for he will not only destroy the morale of his own force but will weaken the morale of other gangs with which he comes in contact.

All men are human and it is impossible to discount or deny human traits. Yet we often see men in supervisory capacities unconsciously doing this by indulging in useless and constant criticism. This results in their subordinates believing them unappreciative. When this belief becomes fixed, it is difficult to obtain extra effort, even in emergency. Whenever a man puts forth his best effort it should be appreciated and fitting expression of that appreciation shown. If this is not done, it may become difficult to obtain the best effort of which men are capable. Most men possess an inherent pride in their work; by stimulating that pride both the man and his superior are benefited. By snubbing that pride the loss is the loss of both.

With the advent of industrial prosperity, convenient transportation and general education, the slave-driving methods which were in vogue two or three decades ago are virtually obsolete. Nevertheless, the slave-driving tendency is an inborn trait of some men and occasionally an exponent of this form of supervision is seen. The men of today, even those who compose the laboring classes, are too far advanced in their knowledge of industrial conditions and industrial opportunities to work long under men of that type. Sooner or later the slave drivers are found out, and the ultimate consequence is their own undoing. Where this method is in vogue, work is done through fear, which is the antithesis of loyalty. Men of this type invariably have to contend with a high labor turnover, which keeps their forces disorganized and materially increases the cost of their work because of the constant breaking in of new men.

Another thing well calculated to weaken or even destroy morale is the ignoring of the formal channels of authority. How can it be possible for a man to remain loyal to his superior if that superior habitually ignores him? In emergencies this does not apply, but any supervisory officer, from the foreman up, who does not resent being told constantly by his subordinates that his boss had given contradictory instructions to him direct, has neither personal pride nor self-respect! What man of substantial caliber would not hotly resent having his plans and instructions changed by his superior acting directly with his subordinate without consulting him? This practice, which is all too freely indulged in, leads to at least one disastrous consequence. The slighted officer feels no responsibility for resulting complications or the carrying out of the project. This brings about lukewarm or even disinterested supervision, and if persisted in will do much to break down the morale of any organization. It should be understood and fully recognized that few men, very few men, can carry out the plans of others as effectively as they can carry out their own plans. Further, it should be known and appreciated that, in general, the

result of an indifferent plan perfectly executed will be better than the result of a perfect plan indifferently executed.

And now we come to insincerity—the greatest obstacle to loyalty and as such an insuperable barrier to the building up of morale. Insincerity gives birth to sneers and engenders sarcasm. Insincerity begets veiled innuendoes and indirect slurs, too subtle to admit of open denial or justified defense. Insincerity breeds distrust and opens the way for serious breaches of faith. When a superior is insincere to his subordinates the subordinates are not long in finding it out. It is difficult to conceal. But what open recourse has a subordinate who meets this condition? Practically none. He must either bear with it or quit. He will do well for himself if he adopts the latter course, for when men are knowingly face to face with this condition their entire faith and trust in their superiors is the ultimate cost. The inevitable consequence is the complete sacrifice of loyalty and loss of morale.

### Conditions Strengthening Morale

Having considered those salient features tending to weaken or destroy morale, let us take up the more pleasant task of discussing the factors contributing to and strengthening morale.

Of first importance is the interest in the work to be performed. It is far more difficult to sustain interest than it is to create it. However, by proper methods and with the proper knowledge of men, interest may be successfully sustained. Probably the surest way of sustaining interest in subordinates is for the superiors to sustain their own interest. How can a subordinate be interested in his work unless he has the supporting interest of his superior? A roadmaster should read, study and observe track work and talk track and track work, not only to his foremen, but also to his superior. Interest creates interest, both in the individual who is interested and in those with whom he comes in contact. Enthusiasm is only interest compounded many times, and enthusiasm is irresistible. You have all met men who were enthusiastic about something that did not directly concern you, but nevertheless it is safe to say that it made a lasting impression, and if you were thrown much with the enthusiast you became greatly interested in the object of his enthusiasm. There is no height to which enthusiasm, tempered with judgment and backed by energy, will not carry a man. The long and much sought secret of success must embrace the making of your chosen work your main interest and subordinating all other interests in side issues thereto, permitting no conflicts. Any man who is deeply and wholesomely interested in his work, and in the accompanying welfare of his men, and who does not expect the impossible, need have little worry about the morale of his forces, providing he has chosen subordinates of the right kind.

Closely allied to the interest in the work is an understanding of the importance of that work. In emergency, when the importance of work is clearly understood by all those engaged in it, men can, for limited periods of time, put forth superhuman effort and attain unbelievable results. Seldom is there seen shirking at a wreck or a washout. Even the laziest and most indolent men seem for the time being to be spurred on by a wholly unaccustomed energy. The reason is not difficult, for they see and appreciate the importance of their work. At these times, pay is not uppermost in their minds. They work willingly and for long hours under terrific hardships, simply because they have a visible measure of their accomplishment which translates itself into satisfaction. This translation of work done into satisfaction should be taught foremen by the roadmaster, and in turn passed to the laborers by the foreman. The return upon this investment is tremendous. It makes for interest in the work by putting it upon a higher plane than the pay check, and directly strengthens morale.

The understanding of men by their superiors is a necessary condition to the creation and sustaining of morale. Superiors should be able to appreciate the perspective of their men, and knowing this, they are in better position to guide and direct their thought along sound and conservative channels. Without this understanding superiors may offend without the slightest intention, or may even bring about a condition entirely opposite from that desired. Unquestionably, men promoted from the ranks have a more comprehensive understanding of the men in the ranks than outsiders. However, men promoted from the ranks have three dangers with which to contend—first, the danger of their broadened perspective making them intolerant with those whose perspective is not so broad; second, the danger of forgetting entirely the horizon as seen from the ranks, and third, the danger of not keeping abreast of constantly changing conditions, resulting in a lack of adaptability.

These three dangers, if appreciated, cease to be dangers, for they can be easily overcome by close contact with the men, by cultivating tolerance and by reading. Close contact with the men is of importance and of benefit to both the men and the superior. Friendship is the product of association and mutual tolerance, while knowledge is the product of the interchange of ideas. Without friendship the acquisition of that practical knowledge and common sense requisite in the handling of men would be difficult. Without friendly direction the acquisition of the technical knowledge necessary to the effective and correct performance of work would be difficult.

But we are not yet through with friendship. Let's follow this greatest of all possessions a step further. Loyalty to a company is often spoken of in an absolute or abstract sense. While this may sometimes be correct, in general the admission can hardly be allowed. Loyalty to a company is intangible and abstruse. However, loyalty to the representatives of a company who are superiors and friends is definite and concrete. Most of the section foremen and section laborers come in direct contact with few of the official representatives other than the roadmaster and division engineer. Their loyalty to the company can be measured by their personal loyalty to those men, which, in turn, is directly dependent upon their admiration and friendship for them. One of the best recommendations a superior can have is the friendship and personal loyalty of his subordinates. This friendship and loyalty is not only an asset for the man himself; it is also an asset of his company. It is said friendship should not be traded on nor capitalized. That is too idealistic to be admitted. It is perfectly proper to both trade on and capitalize friendship so long as it is not betrayed. Whoever heard of anyone being supported by his enemies, and whoever hears of anyone gaining substantial promotion without the long and consistent support of his men.

Some men seem to be afraid to make friends of their subordinates. The fear seems to be that friendship would be exploited and abused. This fear is groundless, if the superior is possessed of a good moral character and exercises good judgment and fair play in handling his men. Men who abuse or impose upon friendship are not the kind to be desired in any organization whether they be friends or not, and the thing to do is to weed out men of that type as fast as they manifest themselves. Furthermore, fast friendship can exist without intimacy, and if any fear is justified, it is because of intimacy and not of friendship. Nevertheless, a man of sound moral character and good judgment has little to fear even from in-

timacy. And be it remembered that the personal character of the head of any organization has a decided and direct influence upon the morale of that organization.

Fair play also has an important bearing on morale. When men have confidence in getting fair play and such consideration as they deserve, the result is an extended and spontaneous strengthening of trust, which in turn is reflected in their morale. Furthermore, when men feel that they can go to their superior with their problems and troubles and receive judicial consideration and sound advice instead of prejudiced haranguing and offensive tongue-lashing, they welcome the opportunity of being open and above board in all their dealings and hesitate to stoop to the concealment even of trifles which might, under less favorable conditions, prove embarrassing.

Fair play and judicial consideration are of double benefit. First, the superior is allowed an intimate insight into the work, problems and troubles of his men, which would otherwise be withheld; and second, the men are in turn benefited by the broader advice and experience of their superior.

All the foregoing leads unavoidably to the greatest of all considerations—education. Education is the key and predominant note of the whole subject of morale—education both as concerns methods and ways of handling the daily task and the further broader education of elementary political economy. Knowledge of the handling of men and the performance of work is a prerequisite, but this knowledge may be indefinitely expanded and amplified by properly directed reading and thinking. The fundamentals of political economy are simple. It cannot be hoped that the science of political economy will be completely mastered by everyone; the subject is itself a life study. It is not too much, however, to hope or expect that the rudiments of this helpful science will become more generally known. When this condition becomes a fact it will not be easy for unscrupulous leaders to perpetrate plausible fallacies which cause unrest because the worker is led into believing he is not receiving his worth.

Why labor objects to having the word commodity applied to it is hard to understand; it must come under and be governed by the law of supply and demand, and no other condition is remotely possible. Again, the price of labor bears a direct relationship to the worth of money, if indeed the price of labor does not wholly control that worth. The wealth of a country is determined by its natural resources, by the products of agriculture, mines, forests, etc. No industry is economically justified which does not contribute in some way to the value of natural resources. To illustrate briefly: The transportation systems are economically justified because they add to the worth of our natural products by wider distribution. The tremendous wheat crops of the northwest would be valueless without this broad distribution because the local population could not possibly consume the quantity of wheat produced, therefore without adequate transportation the surplus over the local consumption would be wasted. Industry can be grouped into two classes, essential industry, which in some way contributes to the value of natural products, and that industry which engages in the production of luxuries. An illustration of industry engaged in producing luxuries is the manufacture of phonographs, or the manufacture of automibiles used solely for pleasure purposes. These articles contribute nothing to the value of the natural or essential products.

Regardless of the amount of actual money received, the basic wage is that which will allow sustenance for an able-bodied laborer. From this base, wages advance in accordance with skill and effort. Uniformly high wages benefit no one, for under that condition the purchasing power of money must inevitably decline. It can be conclusively demonstrated that money of low purchasing value operates a hardship upon the wage-earner.

The American people, especially the working classes, do not appreciate their wealth. Compared to any other nation on earth, the American worker is affluent and in easy circumstances. It should follow that as soon as the American people are educated into a knowledge and understanding of this fact it should make for contentment and the consequent strengthening of industrial morale as a whole.

While on the subject of political economy, there are two facts which deserve mention. First, it is a necessary condition from the standpoint of political economy that invested capital be entitled to a fair return. Second, that the actual valuation of the United States railroads as determined by the Interstate Commerce Commission for the establishment of a fair return to the railroads under the Transportation Act of 1920 exceeded the total capitalization of the railroads by approximately $3,000,000,000, or 15 per cent. This is a direct and incontrovertible answer to the frequent and popular charge of watered stock, or inflated capitalization.

The railroads have been reticent and somewhat remiss in advertising themselves, both to the public and their employees. Without doubt, a more complete and general knowledge of their achievements and difficulties would go far towards gaining a more kindly public sentiment and would help tremendously in the building up of a pride among their employees in their organization, which would immediately be reflected in the morale of their forces.

And in conclusion, it must be emphasized that each of you is charged not only with the directing of the energy of your forces but with the direction and stimulation of their thought, and that each of you should in honor bound feel obligated to fit yourselves to direct that thought along sound lines. On the Kansas City Southern much good can be accredited to the foundation of a maintenance of way association, which has for its object not only the establishment of more friendly relations between the foremen and the management and the discussion of ways and means of performing work, but also the direction of thought along the broader and deeper lines which have been briefly reviewed.

The morale of your forces is as vital as the work they perform, because it controls the effectiveness of the work and the dependability of your organizations. Nothing is too trivial nor too important that will contribute to the upbuilding and strengthening of the morale.

## Co-operation Between the Track and the Signal Departments

By J. A. Peabody

Signal Engineer, Chicago & North Western, Chicago

WHILE I have been on both sides of the fence, having had charge of both track and signal work, I have found some difficulty in approaching this subject. Owing to the unsettled conditions I have had no opportunity for a heart to heart talk with trackmen and signalmen to determine what they considered most important. I finally concluded that the various items in which both parties were interested were altogether too numerous to mention in detail, but that I might discuss one or more of the more important ones in a way that will unquestionably overcome the difficulty often experienced by the two forces by explaining what a thing is for and why it must be taken care of in a certain way. If this method is followed in the field, the supervisors and roadmasters as well as the signal maintainers and section foremen

will get some knowledge of each other's work, and with that knowledge will come a better understanding and greater respect for each other. There need be no fear that either will give away something which will let the other take over his work; this has been tried already and has not succeeded; there is plenty of work for all.

The item of signaling, which brings the two forces together most often, and which is apt to cause the most trouble and is perhaps the least understood, is the track circuit. The importance of the track circuit is perhaps best indicated when I say it is the foundation of the whole signal structure, and, as you know, when the foundation of a structure gives way the whole structure that it is supporting is bound to collapse.

Let me refer to the Bible story of the two houses, one of which was built upon the rock and the other upon the sand. The rains descended and the floods came and the winds blew and beat upon the house on the rock, but it stood, while the house on the sand collapsed, and great was the fall thereof. If the track where there are track circuits was always supported on rock and that rock kept reasonably clean, the signalman would be happy, even when the rain descended and the floods came.

If the track is on slag or coarse gravel and well drained, the foundation is still good when the rain descends or the water collects during the warm part of the day in the early spring and wants to stay with us whether we will or no, and the signalman and the trackman smile and say a pleasant good morning to each other. But when the ballast is not of the best, when the cinders and sand are thick and not only bear against the base of the rail but perhaps a good ways upon it, the signal supervisor should go to tbe roadmaster during the summer when forces are plentiful and they should go over the situation together. In one case the signalman shows the trackman where cleaning out around and underneath the rail will do everything that is necessary. In another case external drainage is required which the roadmaster has wanted for a long time and, with the help of the signalman, is able to get authority to put in. In a third case the trackman shows the signalman some track that he acknowledges is bad but which cannot be taken care of properly without an expense which both agree is out of the question. But as the signalman has wanted to shorten the track circuit at that particular place for a long time, he gets authority to do it with the trackman's help. Thus the weak parts of the foundations are strengthened, and when the thaws of March, the thunderstorms of July and the floods of any time of year come the foundation stands and the roadmaster and the supervisor meet each other in the superintendent's office in the morning ready to extend the glad hand instead of being prepared with a bunch of excuses and without a single reason why the other is entirely at fault for all of the trains being stopped by the signals in the vicinity of Timbuctoo the night previous.

Finally we have the dirty gravel, sand or cinders, or all three mixed together and distributed along the track for a nine-inch raise, with enough in addition to strengthen the shoulders, and left there for three, four or five months until an extra gang arrives. In the meantime no holes are dug through for drainage and no attempt is made to keep at least one rail clear. A period of wet weather comes on and the trains are stopped every night and sometimes during the day, the general manager "jumps" the general superintendent, who passes the buck, somewhat enlarged, to the superintendent, who, if he goes at it right, calls together all who are directly interested and some who should be but aren't. After listening patiently while the signalman and the trackman accuse each other of everything imaginable he gets the signalman to explain how the trackman can help the situation and why, and the trackman sees the point for the first time and agrees to get busy at once. So they separate good friends once more, the signalman in a hurry, however, to see that some of that track battery has not been neglected and allowed to get weak while he was putting the full blame on the track conditions. Once more the foundation, though of sand, has been strengthened and the structure stands when the next storm comes.

### What Is a Track Circuit?

Now, just what is a track circuit? I don't believe that anyone will contradict me when I say that a track circuit is about the weakest link that man ever put in a chain he was depending on for safety and efficiency. The only reason he depends on it is because he has been able to so surround it that, whenever it fails, danger is indicated immediately, while, on the other hand, means of protecting it have been developed so that failures should be very few and far between.

A track circuit is a section of track cut off from the adjacent track at each end by insulated joints. At one end of this section a battery is connected to both rails and at the other end is a relay, also connected to both rails.

When working properly, current flows from one side of the battery over its connections to the rail where, being prevented from getting away from its track section by the insulated joint, it flows toward, to and through the relay coils at the other end of the track section, again being prevented from getting away by the insulated joint. The current then flows to the other rail; still being confined by the insulated joints, it goes directly back to the battery.

But—what I have described is a most unusual condition, because every tie is letting a little of the current pass from one rail to the other without going to and through the relay coils as it was intended to, and likewise at every place where the ballast touches the rail some more current is leaking across without doing any work, so that in the ordinary track section about two-thirds of the current leaks across and only one-third gets to the relay and does its work. Only a certain pressure of current can be sent out from the battery, for if more is started the leakage will be worse, and even less current may reach the relay. While absolutely pure water is a non-conductor of electricity, every particle of foreign matter which is mixed with the water will conduct more electricity than it would without the water.

It can readily be seen, therefore, that when ties, sand, cinders, stones and water get mixed together a good conductor of electricity is created, and the more that this mixture comes in contact with both rails the more current is going to take advantage of it as the easy way back to the battery.

Perhaps a track circuit can be compared to a ladder built of two-inch pipe for legs, with a step at the bottom of the same size pipe and the other steps of one-quarter inch pipe. In the bottom step is introduced a pump and in the top of one leg a piston with a plunger which is to be raised. When these pipes are filled with water and the pump which represents the battery is set to work, the water, representing the current, begins to flow up the leg in which the plunger is located. A certain amount flows from one leg to the other through each step until the top is reached, when, if too much has not been taken away by the lower steps, the plunger, representing the relay, is raised and held up.

If too much water is flowing through the steps, enough does not reach the top to cause the plunger to raise. If the pump is made to work harder or a larger one is put on, which would be the same as putting on more battery, one or more of the small pipe steps are apt to break or

blow out and no pressure will reach the cylinder to raise the plunger, and so nothing is accomplished. In this ladder the plugs at the bottom and top of the legs represent the insulated joints and they must be sound and tight if they do the duty for which they are placed there.

I have used a good deal of time in an endeavor to explain the track circuit and its weaknesses, taking a chance that I might be tiresome in so doing, but unless this is fully understood I am fearful that I will not impress you with the greatest reason why there needs to be co-operation between the signal and track forces. Track circuits are not an unmitigated evil, as demonstrated by the number of broken rails that are disclosed by their use. In this matter of broken rails the trackmen and signalmen get very close together and in most cases co-operate excellently.

In the description of the track circuit I have spoken of insulated joints. These are probably the greatest bone of contention between the two forces. Too often trackmen consider that insulated joints are the devil's invention and adopted by the signalmen to give them trouble.

A trackman would like a nice straight level piece of track without any switches in it, but nature compels us to have grades and curves and the operating department the switches, which you have to maintain whether you like them or not, and you are so used to that you take them as a matter of course. The public demands protection and to obtain it the operating department evolved blocking. To obtain better protection and give greater train capacity to your tracks, the automatic blocking has been developed. In connection with this has come the track circuit, making necessary the changing of the design of certain track joints in order to obtain the desired results. This special joint, however, still remains part of the track, its primary duty being to support the rail, while its secondary duty, and a very important one, is to separate one track circuit from another.

Unfortunately, the design of insulated joints has too often been left to men who considered too much the necessity of insulation and too little the necessity of track, or that there was a very close relation of one with the the other in the long run. They also overlooked the fact that a section gang, to say nothing of the track walker, did not carry a tool room around with him and therefore if bolts of the weakest joint to be maintained, and therefore the ones requiring the most attention, have nuts requiring a different size wrench from the one for the standard joints the chances are that this weak joint will through necessity get no attention whatever. Within the past few years both railroads and manufacturers of special joints have recognized and corrected this, although a great many with the old trouble are not only still in service but being manufactured. There are other features of the insulated joint which can be and in some cases have been materially bettered. Signalmen can cooperate in the designing of joints which will be comparatively strong from a track standpoint without weakening them in insulation.

Signalmen, understanding the requirements and necessity of insulation, should watch the joints carefully, advise the trackmen when they are getting weak in sufficient time so that the trackmen can get after them without upsetting their whole work program and should stand ready to assist in making changes, especially when the section foreman has a large gang of green men. We should all realize that we are working for the railroad and not for an individual department only.

Bond wires are much of a nuisance to trackmen, getting in the way of the spikes and bolts, but the signalmen are finding that it is to their own advantage to prevent them from being broken and to avoid signal failures they protect these bond wires or put them where they are out of the way.

In order to get the maximum protection against broken rails the battery and relay connections are made close to the insulated joints and naturally the most convenient location to place the trunking for the cross connecting wires is between the joint and shoulder ties just where it is of the utmost importance to the trackmen that there should be absolute freedom for tamping the ties that require the most attention. Here is where the trackman should explain to the signalman the necessities of track maintenance and he can no doubt thereby get him to place this trunking between the third and fourth ties from the joint where there is much less objection.

The effect of treated ties on track circuits is somewhat aside from our subject, but a brief statement may be of interest. So far as I know the only treatment which has proven objectionable and therefore need be considered is that generally referred to as the zinc treatment. Ties so treated are unquestionably conductors of electricity for a time, but in approximately one year the difficulty seems to disappear. After considerable experimenting it has been made evident that if the ties in any one track circuit are changed out on an eight year basis, that is not to exceed 12½ per cent changed out in any one year, the difficulty produced will not be sufficient to cause actual circuit failures. If this system is carried out consistently zinc-treated ties may be installed without difficulty.

Neither section foremen nor signal maintainers are noted as diplomats and lack of diplomacy, or, to put it plainly, common decency, at times on the part of both parties is the cause of a great deal of the trouble between the men in the two lines of work. While in conference with some signalmen a short time ago I asked them what, in their opinion, was the greatest cause of trouble, and therefore of lack of co-operation, between track and signalmen and was very much surprised to have this comeback: "When a maintainer wants work done he wants it done at once, but if the section foreman wants something done the signalman wants it postponed to a more convenient time for him." Also: "When work is being done in which the maintainer is interested he always wants to boss the job." This statement may be somewhat strong, but I am inclined to think there is more truth than fiction in it.

It is hardly possible to cover every point which requires joint action of the track and signal departments in a single paper. Some items which have not been mentioned are: Insulated switch rods, location of switch stands, adjustment of switches, location of pipe lines in interlocking plants, cleanliness of pipe lines in interlocking plants, location of battery receptacles where they interfere with drainage, cleaning away snow and ice, drainage around switches, pipe lines, etc., creeping or running rail, etc.

In planning large extra gang work in which signalmen are interested such as relaying rail it would be well for roadmasters and signal supervisors to get together. If possible roadmasters should so carry on their work that the signalmen can finish up directly behind them at the close of each day.

In conclusion, I want to repeat that the items in which the signal and track forces are interested are too numerous to take up in one paper. They also vary on each section and division so that the only way for them to be brought out and understood is for each party to have patience with the other and be willing and ready to tell what each thing is for and why it must be taken care of in a certain way. This will result in that which we all desire so much—*perfect co-operation*.

## Other Features

On Tuesday evening a program was presented commemorating the fortieth anniversary of the organization of the association, at which short addresses were made by J. A. Kerwin, who was president of the association when it met in Cleveland in 1887, and by a number of other past presidents and members. On Wednesday evening the Track Supply Association gave a dinner to the members of the Roadmasters' Association and their guests, at which E. S. Jones, official photographer of the Boston & Maine, presented an address on the Beauties of New England, illustrated by slides and moving pictures. On Thursday afternoon an inspection of the Cleveland terminals of the New York Central, the Nickel Plate and the Pennsylvania was made by special train.

### Closing Business

The report of the secretary showed 71 applications for membership, giving a total membership at the end of the convention of 1,226. The report of the treasurer showed $1,700 on hand.

An amendment was adopted providing for the creation of a retired active membership classification for those members who have been active members in good standing in the association for at least 10 years prior to their retirement from railway service.

The following officers were elected for the ensuing year: President, J. P. Corcoran, roadmaster, C. & A., Bloomington, Ill.; first vice-president, J. B. Martin, supervisor, N. Y. C., Elkhart, Ind.; second vice-president, W. E. Muff, roadmaster, A. T. & S. F, Newton, Kan.; secretary, P. J. McAndrews, roadmaster, C. & N. W., Sterling, Ill.; treasurer, T. F. Donahoe, general supervisor of road, B. & O., Pittsburgh, Pa.; members executive committee (two years), H. R. Clarke, district engineer, C. B. & Q., Lincoln, Neb.; B. C. Dougherty, roadmaster, C. M. & St. P., Chicago; (four years) J. P. Davis, roadmaster, Central Indiana, Anderson, Ind., and C. H. Gruver, roadmaster, C. R. I. & P., Manly, Iowa.

It was voted to hold the convention in Chicago on September 18 to 20, 1923.

The following subjects were selected for consideration and report at the next convention: (1) The Maintenance of Yard Tracks; (2) Methods of Training Foremen; (3) Continue Study of Labor-Saving Devices; (4) The Economy of Conducting Rail Laying, Ballasting and Similar Operations Without Interference by Traffic on Multiple Track Lines; (5) Economical Standards of Maintenance for Light Traffic Branch Lines.

# The Track Supply Exhibit

APPROXIMATELY 50 firms presented exhibits of track materials and equipment in rooms adjoining the convention hall. In addition approximately 13 firms were present without exhibits.

The officers of the Track Supply Association for the past year were: President, Herbert T. Potter, vice-president, Wyoming Shovel Works, Wyoming, Pa.; vice-president, F. M. Condit, railroad department, Fairbanks, Morse & Co., Chicago; secretary-treasurer, W. C. Kidd, Ramapo-Ajax Corporation, Hillburn, N. Y.; advisory directors, E. T. Howson, editor, *Railway Maintenance Engineer*, Chicago, and R. A. Van Houten, vice-president, Sellers Manufacturing Company, Chicago; directors, Alex. Chapman, western sales manager, Rail Joint Company, Chicago; J. J. Cozzens, salesman, Union Switch & Signal Company, New York; A. H. Told, general manager, Positive Rail Anchor Company, Marion, Ind.; and K. J. Eklund, vice-president, Mudge & Co., Chicago; ex-officio, David T. Hallberg, general sales manager, P. & M. Company, Chicago.

The following is a list of the companies participating in the exhibit, with the nature of their display and the names of their representatives:

Aeroil Burner Company, Inc., Union Hill, N. J.; oil burners, hand pumps and compressed air for throwing; J. L. Howland.

American Chain Co., Bridgeport, Conn.; rail clamps, replacers, rail benders, one-piece guard rail, compromise joints; J. J. O'Connell.

American Hoist & Derrick Company, St. Paul, Minn.; photographs of ditchers; W. B. Maurer and Miss H. Holler.

American Valve & Meter Company, Cincinnati, Ohio; switch stands and track appliances; J. T. McGarry, F. C. Anderson and Dan J. Higgins.

Balkwill Manganese Crossing Company, Cleveland, Ohio; model of an articulated managese steel crossing; S. Balkwill.

Bethlehem Steel Company, Bethlehem, Pa.; switch stands, guard rail, gage rods; Neil E. Salsich, E. H. Gumbart, J. F. Hennessy, G. Riddle, J. S. Clark, J. H. Richards, C. A. Alden and J. C. Chandler.

Buda Company, Chicago; section motor car, switch stand, track jack; J. E. Murray, F. T. Connor, A. L. Bliss and H. C. Beebe.

Chicago Malleable Castings Company, Chicago; rail anchor tie plate, tie plate with key, rail anchor tie plate with key, rail clips, bumping posts; Warren Osborn.

Chipman Chemical Engineering Co., New York; photos of track; M. McComb and A. H. Caldwell.

Craft Incorporated, New York; light weight inspection car with chemical fire fighting tank and acetylene cutting and welding outfit; Albert J. Leonard.

Crerar, Adams, & Co., Chicago; bonding drill, track drill, rail saw, die starters, jacks, snow brooms, shovels, etc.; Russell Wallace, W. I. Clock and J. A. Martin.

Dayton Car Wrench Company, Dayton, Ohio; car wrench; H. L. Flack.

Doughtry Safety Guard Rail Lock, Chattanooga, Tenn.

Duff Manufacturing Company, Pittsburgh, Pa.; jacks; F. A. Johnson.

Eymon Crossing Company, Marion, Ohio; model of continuous crossing; Byron E. Wilson and A. C. Queen.

Fairbanks, Morse & Co., Chicago; literature; A. A. Taylor, E. C. Golladay, F. J. Lee, F. M. Condit, G. W. Lewis, H. L. Hilliary, D. K. Lee, J. L. Jones and E. J. Coverdale.

Fairmont Gas Engine & Railway Motor Car Company, Fairmont, Minn.; light inspection car, 6 h. p. section gang car; H. E. Wade, W. E. Kasper, W. D. Brooks and S. J. Gibson.

Hauck Manufacturing Company, New York; thawing outfits, kerosene torches, circular flame burners, blue flame oil burners and syphon type furnace burner; Herbert Vogelsang.

Hayes Track Appliance Company, Richmond, Ind.; derail and model showing a cross-section of actual operation; H. J. Mayer, S. W. Hayes, H. H. Jenkins and R. H. Gausepohl.

Headley Good Roads Company, Philadelphia, Pa.; bituminous railroad crossing; F. X. Kern and W. T. Gilbert.

Idol Track Lining Company, Cleveland, Ohio; track liners; F. R. Sinning.

Ingersoll-Rand Company, New York; pneumatic tie tamper, pneumatic rail drill, pneumatic nutting machine and pneumatic bonding drill; W. H. Armstrong, J. N. Thorp, Jr., and Charles Dougherty.

Kalamazoo Railway Supply Company, Kalamazoo, Mich.; literature; J. J. McKinnon, F. E. McAllister and H. R. Miller.

Lundie Engineering Corporation, New York; tie plates, rail anchors; W. S. Boyce, W. Brooke Moore and L. B. Armstrong.

Maintenance Equipment Company, Chicago; friction car stop, steel fence post, blue flag derail, rail layer, ballast screen, switch point straightener, tie spacer; J. A. Roche and E. Overmier.

Mudge & Company, Chicago; railway motor car; Karl J. Eklund, John M. Mulholand and Burton Mudge.

National Lock Washer Company, Newark. N. J.; nut locks and lock washers; J. Howard Horn, R. L. Cairncross, A. T. Thompson and Stanley H. Smith.

National Malleable Castings Company, Cleveland, Ohio; wrecking hook, malleable iron washers, rail braces and tie plates; E. V. Sihler.

Oxweld Railroad Service Company, Chicago; reclamation of track materials by the oxy-acetylene process; W. H. Kofmehl, L. C. Ryan, F. J. Duffy and W. R. Allen.

P. & M. Company, Chicago; anti-creepers; S. M. Clancy, D. T. Hallberg, L. S. Walker and F. N. Bayliss.

Pocket List of Railroad Officials, New York; copies of publication; Charles L. Dinsmore.

Positive Rail Anchor Company, Marion, Ind.; girder type guard rail, rail anchors, rail braces, guard rail plates and braces and tie plates; A. H. Told and L. C. Ferguson.

Rail Joint Company, New York; insulated joints, compromise joints, standard joints and Rajo track liner; Charles Jenkinson, R. W. Payne, Alex. Chapman, G. T. Willard, C. B. Griffin, J. N. Meade, W. E. Gadd, Milton Markley and E. A. Condit.

Railroad Supply Company, Chicago; tie plates; G. W. Nibbe and H. G. Van Nostrand.

Railway Purchases and Stores, Chicago; copies of publication; Edward Wray.

Railway Review, Chicago; copies of publication; W. M. Camp.

Ramapo-Ajax Corporation, Hillburn, N. Y.; automatic switch stand, double shoulder switch plate, manganese guard rail, guard rail clamp, adjustable rail brace; W. C. Kidd, R. J. Davidson, Jr., J. B. Snow, J. B. Strong, T. E. Akers and John V. Houston.

Reade Manufacturing Company, Jersey City, N. J.; model of chemical weed killing machine; C. H. Reade, R. H. Bogle and R. W. Pritchard.

Reliance Manufacturing Company, Massillon, Ohio; nut locks; H. J. McGinn, E. C. Gross, D. L. Robertson and H. R. Hanna.

Selflock Nut & Bolt Co., East Syracuse, N. Y.; track bolts with lock nuts; M. E. Jennings, I. C. Woodward and F. W. Piche.

Sellers Manufacturing Company, Chicago; tie plates; G. M. Hogan and R. A. Van Houten.

Simmons-Boardman Publishing Company, New York; Railway Age, *Railway Maintenance Engineer*, Maintenance of Way Cyclopedia and Roadway and Track; E. T. Howson, Milburn Moore, F. C. Koch, B. J. Wilson, F. H. Thompson, E. A. Lundy, R. H. Smith and W. F. Rench.

Stevens Metal Products Company, Niles, Ohio; galvanized fence posts; Stanley H. Smith, George J. Purcell, E. D. Thompson and E. L. Ruby.

Templeton Kenly & Co., Ltd., Chicago; track jacks, car jacks, pole jacks and emergency jacks; J. L. Crowley, G. L. Mayer and H. A. Walters.

Union Switch & Signal Company, Swissvale, Pa.; insulated rail joints; J. J. Cozzens.

Verona Tool Works, Pittsburgh, Pa.; railroad track tools, nut locks, track jacks, rail joint springs; E. Woodings, W. W. Glosser, J. S. Wincrantz and J. E. Hill.

Warren Tool & Forge Company, Warren, Ohio; adzs, crowbars, picks, spike mawls, sledges, hammers, track chisels; H. C. Mull, George F. Konold and George F. Konold, Jr.

William Wharton, Jr., & Co., Inc., Easton, Pa.; manganese steel one-piece guard rail, gage rod, photograph of plant; Victor Angerer, W. H. Allen, H. F. Heyl, J. R. Smith and C. W. Smith.

Wood Shovel & Tool Company, Piqua, Ohio; Molybdenum steel shovels; E. H. Hoge and C. L. Butts.

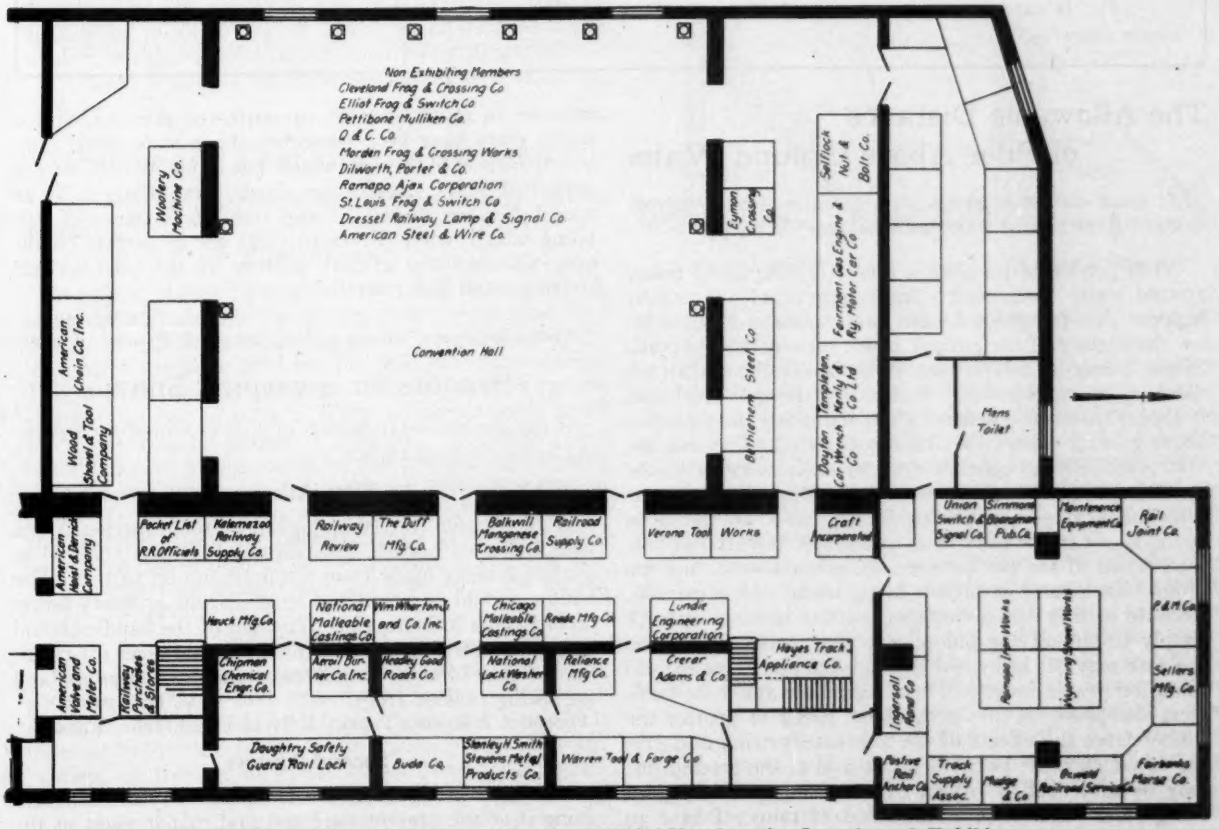
Woolery Machine Company, Minneapolis, Minn.; literature; H. E. Woolery.

Wyoming Shovel Works, Wyoming, Pa.; track shovels, spades, scuffle hoes and picks; H. T. Potter, Stanley H. Smith, G. E. Geer, A. W. Greetham and E. L. Ruby.

### Non-Exhibiting Members

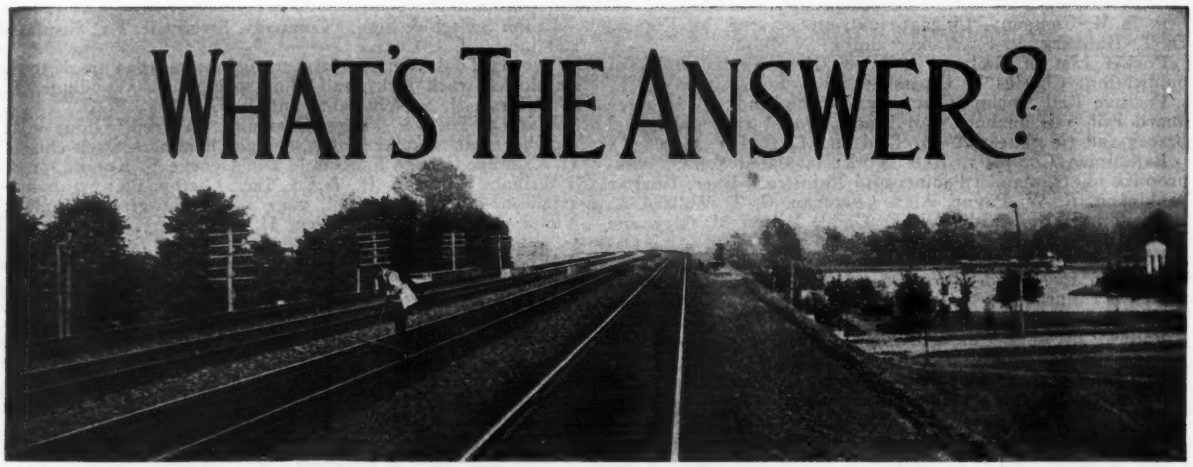
American Steel & Wire Company, Chicago.
Cleveland Frog & Crossing Co., Cleveland, Ohio.
Cleveland Railway Supply Company, Cleveland, Ohio.
Elliott Frog & Switch Company, East St. Louis, Ill.
Dilworth, Porter & Co., Pittsburgh, Pa.
Dressel Railway Lamp & Signal Company, New York.
Jordan Company, O. F., East Chicago, Ind.
Morden Frog & Crossing Works, Chicago.
Pettibone, Mulliken Company, Chicago.
St. Louis Frog & Switch Company, St. Louis, Mo.
The Q. & C. Company, New York.
Universal Crane Company, Cleveland, Ohio.

At the annual meeting held on Thursday morning the following officers were elected for the ensuing year: President, F. M. Condit, railroad department, Fairbanks, Morse & Co., Chicago; vice-president, J. J. Cozzens, salesman, Union Switch & Signal Company, New York; secretary-treasurer, W. C. Kidd, Ramapo-Ajax Corporation, Hillburn, N. Y.; director (two years), J. Howard Horn, sales manager, National Lock Washer Company, Newark, N. J.




**The Floor Plan of the Track Supply Exhibit, Showing the Location of Exhibitors.**

# WHAT'S THE ANSWER?



This department is an open forum for the discussion of practical problems of maintenance of way and structures. Readers are urged to send in any questions which arise in their work in the maintenance of tracks, bridges, buildings and water service. The *Railway Maintenance Engineer* also solicits the co-operation of its readers in answering any of the questions listed below.

**The following questions will be answered in next month's issue:**

(1) *What is the best method of removing snow from the larger station platforms?*
(2) *In sinking a system of tubular wells, what steps should be taken to determine how many wells to drive and how far apart the wells should be sunk?*
(3) *What is the most effective means of protecting the floors of steel bridges from brine drippings?*
(4) *At what point in the switch leads do ties fail most quickly?*
(5) *What is the best way of sealing up a spring encountered when sinking a foundation or pit or in laying a culvert floor?*
(6) *In cases where a long pipe line is laid with the contour of the land, how high, ordinarily, may the crests be before warranting the installation of air relief valves?*
(7) *What are the best ways to handle steel sheet piling in driving, rendering waterproof and pulling?*
(8) *What types of paints or other coatings has experience shown to be capable of withstanding engine-house gases?*

## The Allowable Distance of Piles Above Ground Water

*At what elevation above ground water level is it safe to cut off untreated piles without fear of decay?*

While good practice always favors driving piling below ground water level where this is practicable, it usually happens that the ground water level is some distance below the surface of the ground, if not entirely beyond reach of the piling, in which case it is manifestly out of the question to consider this factor in driving. Nor does it appear material whether or not the piling does project above ground water. My observations of piling indicate that practically no concern need be entertained as to the condition of piles except where exposed to alternate wetting and drying. In practically all cases the piling is found to rot in the immediate vicinity of the ground line, the portion of the pile between the ground water and the ground line almost invariably being found well preserved. Because of this it is a common practice in renewal work simply to cut off the old piles a few inches or feet, as the case may be, below the ground line and leave the old piling otherwise intact. There seems always to be sufficient dampness in the earth about piling to protect the timber from the effects of the alternate wetting and drying to which those portions above and at the ground line may be subjected by reason of the rising and falling of the ground water level or the effect of rains. I have an instance in mind of a set of untreated piles which for many years have been protected above water level only by rip rap and the silt which has accumulated over a period of years. Inspection shows these piling to be as sound as when driven. I also recall an instance of oak piling which, while driven in 1888, are in perfect condition, although the greater portion of the piles extend above ground water level.

I. L. SIMMONS,
Bridge Engineer, Chicago, Rock Island & Pacific, Chicago.

## Brooms for Sweeping Snow

*What are the requirements of a good broom for sweeping snow from switches?*

### First Answer

A good broom for sweeping snow from switches is one with a thin stiff brush, substantially built, the material in the brush being made from rattan or similar nature. The handle should be about the length of an ordinary house broom and a little heavier. The end of the handle should be equipped with a chisel pointed piece of steel for cleaning ice that often accumulates around switch points and the spring rails of frogs.

V. H. SHORE,
Foreman, Atchison, Topeka & Santa Fe, St. John, Kansas.

### Second Answer

We have used the rattan brooms for years and are using it at the present time and find that it gives us the

best satisfaction. The steel broom does not give as good service owing to buckling of the strands. We have also found thawing outfits handy for use in cleaning switches. These outfits burn kerosene and can be handled by one man. It is a money saving device for the company around interlocking plants.

D. O'HERN,
Roadmaster, Elgin, Joliet & Eastern, Joliet, Ill.

## Blue Stain in Lumber

*What is blue stain in lumber? Is it harmful?*

There are two types of wood stains: (1) those due to purely chemical reactions in sound wood; and (2) those produced by fungi. Blue stain is common in the sapwood of a large number of woods, both of the hardwood and the softwood groups. The fungus causing the stain grows rapidly and the stain may appear in a log or board soon after it is cut. The minute threads of the fungus in the wood tissues are responsible for the blue-gray discoloration. Blue stain at first appears in spots or streaks. Later as the fungus develops deep in the wood, the entire sapwood may be discolored. In this stage it can not be surfaced off.

Blue stain, itself, contrary to a common belief, is not an early stage of decay, but merely the discoloration due to the presence of these fungi within the wood. However, a luxuriant development of fungus stain implies that the timber has been piled in a moist, poorly ventilated condition, which also favors infection with true wood-rotting fungi.

Blue stain is freely accepted in rough lumber, lath, scantling, plank and a certain amount of the larger dimension stock and is acceptable for any other work where the discoloration is to be covered effectively with paint or otherwise hidden from view. Fungus stain can be prevented by kiln drying or can be largely controlled by open piling in air drying, or better, by dipping the fresh stock in antiseptic solution and then piling properly.

United States Forest Products Laboratory, Madison, Wis.

## Preventing Cracking in Radiators

*How may the cracking noises in steam heating coils be avoided?*

### First Answer

In general it may be said that there will be no cracking noise if the steam heating plant is properly designed and built. The noise is caused by water which has become trapped in the pipes because they will not drain readily. This water is forced from one point to another by the steam pressure, making a sharp sound at each point where its rushing action is retarded. Sometimes the introduction of a common globe valve where a gate valve should have been used will back up enough water to cause this noise. The remedy is to perfect the drainage and exercise care not to open the steam valve too quickly on a large coil of cold pipes.

EDWIN M. GRIME,
Supervisor Bridges and Buildings, Northern Pacific, Fargo, N. D.

### Second Answer

I have had occasion to make some investigations regarding the cause and remedy of water hammer in radiators, heating coils and steam pipes, and I find that in most cases this is caused in radiators by improper venting, or the use of globe valves instead of regular radiator valves. For instance, if a globe valve is used on a one-pipe low pressure steam installation, and the water of condensation is made to flow over the seat of the valve, the incoming steam will cause this condensate to dam up within the radiator until a slug of water will go over into the main, causing what is known as water hammer.

In piping I have found that it is almost invariably caused by the improper grading of pipes, that is, steam mains that are put up with hangers too far apart or which are put up with crooked or bent pipes. These form pockets that collect the water, and as soon as a slug of sufficient size moves on, it strikes the elbows, return bends, etc., causing the noise known as water hammer.

Water hammer should not be confused with the cracking noise sometimes made in cold radiators at the time of turning on steam. Here the steam condenses so rapidly as to often form a vacuum, causing the condensate actually to be drawn back sharply into the radiator.

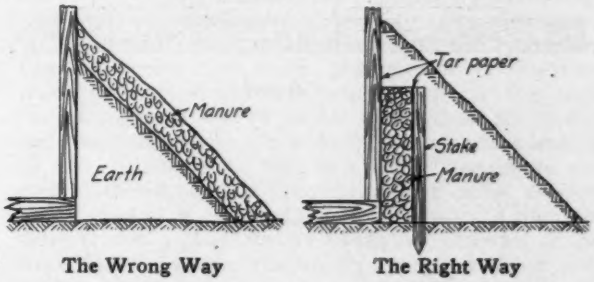
In general if the steam mains are graded down with a pitch of ½ in. in 10 ft. in the direction of flow of the steam, if radiator valves are used on the radiators and good air vents are used on both coils and radiators, very little trouble will be experienced from water hammer.

HOMER R. LINN,
Engineer, American Radiator Company, Chicago.

## Banking Buildings in Winter

*What is the best method of banking buildings during the winter in cold climates?*

The superior value of manure as a material with which to bank buildings in winter is well recognized at points subject to unusually low temperatures for considerable periods. It will pay to go to some trouble to obtain it. The situation often presented, however, is one where enough manure cannot be obtained for all requirements, in which case it is customary to use sparingly what




The Wrong Way The Right Way

manure is available and fall back on earth to make up the deficiency.

Unfortunately, when this condition is met, the manure available is often not used to the best advantage. Some instances of banking almost indicate that the real purpose of the banking was entirely overlooked. As an example of this, one of the sketches affords an illustration showing a banking job in which the manure was placed on the outside. Obviously, the heating value of the manure is quite lost by the practice.

The second sketch shows a better way of effecting the banking. In this case, a strip of tar paper is tacked to the building and a second strip to a line of stakes driven about six inches or more away, depending upon the quantity of manure available. The space is then filled with manure, after which sufficient earth is applied to cover the layer of manure both top and bottom. An observation well worth mentioning in this connection is that the earth will better assist the manure in keeping out the cold when packed loosely rather than tightly. By proceeding in this manner the manure is made to go further and is not only protected against dislodgment

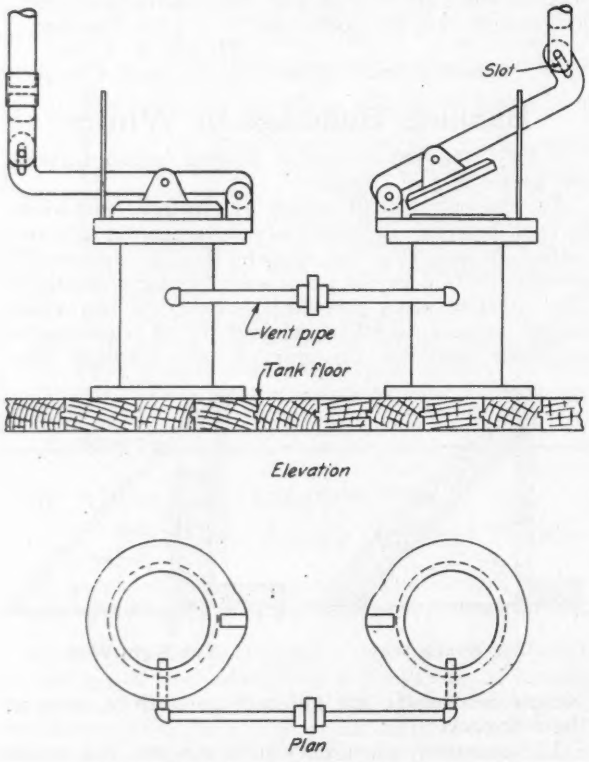
but is in a place where its heating value is utilized to the best advantage.

## Preventing Pounding in Roadside Tanks

*What can be done to overcome pounding of the outlet valve in a roadside tank when closed?*

### First Answer

The accompanying illustration shows how a valve pounding problem was met in a 100,000 gal. tank in which are two outlet valves, one for each track served by the tank. In this case, the tank was carried on a 50 ft. tower, the height of which, together with 20 ft. of water in the tank, created an unusually high velocity in water passing into the tank spouts. Owing to the high velocity, the sudden cutting off of the flow of water when a valve was released would set up a surging in the long column of water below the valve by reason of the




**How the Chattering Was Prevented**

vacuum created, which caused such serious pounding in the valve as to bend the 2 in. valve lever to a point where the valve would no longer seat tightly, not to speak of the cutting of the valve seats which would take place. This condition was aggravated by the use of about 25 ft. of 2 in. pipe for a lifting lever, which, while supplying the weight necessary to start the valve downward when closing, served to multiply the force of the impact of the quick closure.

Two things were done to prevent this trouble. The first was to establish a pipe connection between the two valve standards above the floor of the tank and below each valve. Since one discharge pipe is always open to the air this pipe permits air to enter the pipe in use, thus breaking the vacuum which causes the pounding. Furthermore since the vent pipe connects the discharge pipes in both cases, if any water passes through this vent pipe, it will be discharged through the spout line, as a result of which no opportunity is afforded in winter for the vent pipe to become closed by the freezing of water at the exposed end.

Supplementing this change, each valve lever was slotted at the lifting end and the pull rod adjusted so that while the heavy pipe would start the valve downward when closing, it would leave the valve to close under its own weight and the weight of water upon it. The results of these changes were entirely satisfactory.

### Second Answer

The pounding of the outlet valve in a road-side tank can be prevented by any means which will vent the discharge pipe or "gooseneck" when the valve is closed. We have found it practical to tap the gooseneck on 6 in. to 10 in. outlets at a point 8 in. to 10 in. below the floor of the tank and place a 1 in. nipple with a 1 in. swing check valve for venting. It is also practical, on some types of outlet valves or where the valves set upon an extension pipe above the floor of the tank, to tap below the valve seat with a ¾ in. or 1 in. pipe and extend a riser pipe vertically inside the tank far enough to project the open end above the water line. The slow closing device, consisting of a balancing cylinder and piston, will also prevent the pounding of outlet valves and can be used successfully where the water does not contain material which will cause incrustation. W. M. NEPTUNE,
Principal Assistant Engineer, Missouri Pacific, St. Louis, Mo.

## Proper Submergence of Pump Suctions

*In general, how far should the intake end of a suction line of a pump be submerged below the surface of the water to avoid surging or air sucking?*

### First Answer

Generally speaking, it will usually be found that a submergence of two diameters is sufficient for all ordinary purposes. This should be increased, of course, in all cases where freezing of the surface water is encountered. M. D. MILLER,
President, Railway Water & Coal Handling Company, Chicago.

### Second Answer

The intake end of the suction line of the pump should be submerged sufficiently below the surface of the water so that a whirlpool, and the depth therefore depends upon the size of the pipe and the capacity of the pump. We find that a submergence of 24 in. on a 6 in. pipe handling 200 gals. per minute (12,000 gals. per hr.) is ample, and that as general practice a 3 ft. or 4 ft. submergence should be maintained. It is, however, possible to operate without breaking the priming of the pump with only sufficient submergence to cover the foot valve or intake end if some means is employed to baffle the flow into the pipe and prevent a whirlpool.
W. M. NEPTUNE,
Principal Asst. Engineer, Missouri Pacific, St. Louis, Mo.

### Third Answer

Like many other problems, the correct solution of this depends very largely on local conditions. The size of the vortex formed at the entrance end of an intake pipe will depend upon the size of the pipe and the velocity with which the water is drawn through the pipe. Surging or air sucking will depend on whether or not this vortex reaches to the surface of the water where it can get air.

In the case of a 12 in. suction line about 200 ft. long with a 50,000 gal. capacity centrifugal pump drawing on

the line, a vortex 30 in. deep has been noted. This can be overcome by projecting a piece of timber or other article into the vortex so as to destroy the whirlpool action.

For intakes from sedimentation basins or streams carrying much silt, it is often desirable to draw only the supper strata of water which are most nearly settled. The float controlling the depth of the intake below the water surface may in some cases be so designed as to cover the area where the whirlpool action will tend to take place and in this way permit the intake to be placed closer to the surface than otherwise possible. A perforated or slotted enclosure casing of much larger diameter than the opening of the pipe will also tend to prevent the whirlpool action.

In general for ordinary conditions it is safe practice to place the intake end of the suction line 3 to 5 ft. below the water surface. EDWIN M. GRIME.

## Renewing Switch Ties

*Should switch ties be stocked, distributed and renewed in sets or singly?*

### First Answer

In renewing switch ties they should be stocked and distributed in sets. As switches are the most critical units in a track, safe conditions must be maintained and all ties should be renewed at the same time unless there is some exceptional reason to the contrary.

This method is safe and allows the organization of several gangs, each doing a special kind of work. The method of placing two or three ties at a time is costly, the only advantage being that the track can be kept safe for trains at high speed. G. E. STEWART,
Assistant Engineer, Southern Pacific, Stockton, Cal.

### Second Answer

Switch ties should not be stocked in sets, for when shipped in this manner one box car will only hold two sets, while if distributed singly there is room for three sets. It is easier to stock switch tie by length and sizes, as they can be piled more compactly and protected better from the winter. In renewing switch ties many can be left in track for two or three years, after others, particularly under frogs, have to be removed. By removing only those which should actually come out, a saving in timber can be effected and unnecessary disturbance of the roadbed avoided. THOR MONRAD,
Section Foreman, Northern Pacific Railway, Dickinson, N. D.

### Third Answer

Switch ties should be stocked singly for the following reasons: (1) they can be handled more expeditiously by eliminating the possibility of errors in assembling sets, thus contributing to economy; (2) they require less space for stocking; (3) they can be piled with more ease to allow proper ventilation.

Switch ties should be distributed and renewed in sets, the principal reasons for which are as follows:

(1) Economy of timber and maintenance. (a) When renewing by sets, the sound timbers can be utilized in making up second hand sets for use in side tracks or at points of light or infrequent traffic. In this manner, longer or more uniform life is given to the ties making up the set. This practice eliminates the necessity of annual renewals. (b) It eliminates the possible necessity of framing new timber.

(2) Insures proper spacing of ties. In most cases, that is in yard tracks, the life of the tie is greater than that of the rails and fastenings which they support. When a frog or switch is renewed (especially the former) it is usually noted that some ties require respacing to insure proper bearing. This condition is usually found at nearly every turnout where ties are to be renewed. When renewals are made, it is a well known fact that the spacing of a few ties cannot be accomplished in a satisfactory manner. L. S. WEAVER,
Supervisor of Track, Erie, Attica, N. Y.

### Fourth Answer

Renewing switch ties in sets depends upon several conditions, the principal one being the percentage of ties to be renewed. In my opinion ties should be renewed singly in any main track switch unless the amount to be changed out exceeds 35 per cent. Another condition is the importance of the switch. Where not used much switches could have renewals made singly where half or more were bad and could be renewed, using ties recovered from other switches. No fixed rule can be followed on account of widely varying conditions. It should be left to the judgment of the roadmaster and foreman as to where and when a set of switch ties should be renewed out of face. Foremen in large yards can utilize all their recovered ties from important switches by placing them in their less important ones and thereby get full use from them.
V. H. SHORE

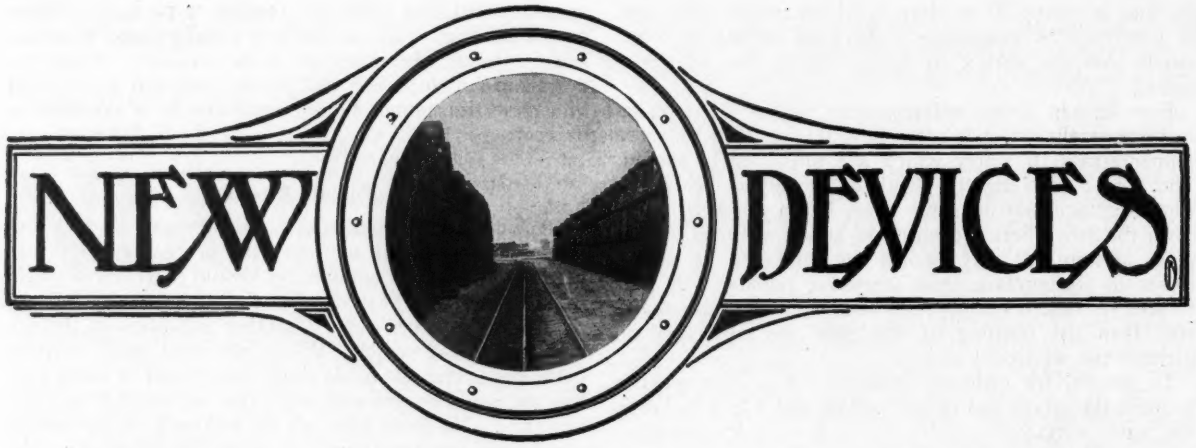
### Fifth Answer

Entire new ties represent the maximum "margin of safety," but it is plain that this highly comforting situation is one of brief duration. Deterioration starts in at once and hence it is something less than perfect—something partly worn out with which we have to live. Track must at all times be equal to the demands put upon it, that is, to support its traffic in safety. Therefore, a more important consideration than the quality of track afforded by the widest "margin of safety" is the most economical means for keeping requisite substantiability within allowable limits of depreciation.

Ties, even those of apparently close similarity, are far from uniform in their decay resisting qualities. Furthermore, ordinary mechanical wear as well as the more violent rigors of service do not attack them all evenly, and, as a result, there is a wide difference in their lengths of life. Inasmuch as ties, as a whole, deteriorate unevenly, threats to the integrity of the track develop locally, and it is in the face of a "spotted" condition that decision is called for as to whether renewals at the weak "spots" or entire renewal by sets (the latter involving the removal from the track of much material still capable of service), will bring about eventual economy.

It is the writer's opinion that any argument in favor of the renewal by sets must be based on operating conditions wholly, and it is his experience that these conditions must be exceptionally adverse for maintenance purposes to justify the waste of usable materials which this method entails. The danger of heavy loss in usable materials makes it inadvisable to formulate a definite line of procedure for the renewal of ties by sets, but rather that such renewals should be made only after investigating the merits of each individual case each time substantial renewals are to be made. As a general rule, economy in switch tie renewals is best served by making each tie give up its fullest available service before taking it out of the track.

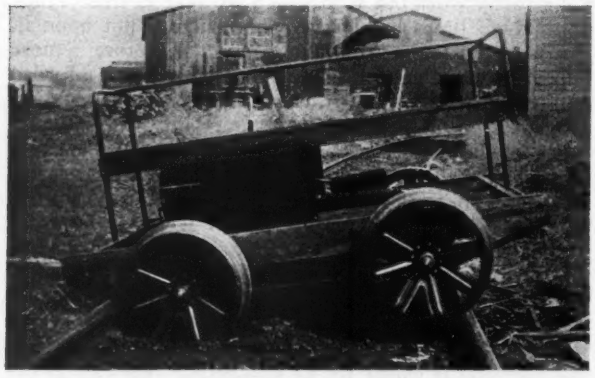
With reference to stocking ties, if ties are required on the road by sets they should be delivered in the same manner, but it is doubtful if it ever is advisable to stock ties, which are intended for maintenance, by sets, due to different lengths or turnouts requiring different numbers of ties per set. E. D. SWIFT,
Engineer Maintenance of Way, Belt Railway of Chicago.




## A New Railway Motor Car

FOR SEVERAL years the Woolery Machine Company, Minneapolis, Minn., has had on the market a special type of internal combustion engine called the Woolery railway motor which it has been manufacturing in sizes ranging from 5 hp. to 15 hp. for use on various kinds of railway motor cars. This company has now enlarged the scope of its activities by entering upon the manufacture of a complete motor car.

Unusual simplicity is the predominating feature of this car, a feature which arises both from the character of the construction and the arrangement of parts. The frame of the car is of hard maple, 1¼ in. thick by 5½ in. deep. As shown in the illustration, this is reinforced by channel irons which pass underneath the axle bearings, the channels being bolted to the side frame pieces at each bearing housing and being bent up at each end, thus forming a semi-underslung type of construction. Aside from the strength given to the car by this construction of the side sills, an unusual amount of clearance is provided at the ends of the car, by reason of which the frame will not come in contact with the rail when the car is removed from the track. Additional features of the frame lie in the floor which is placed low in the body, thus forming a tool tray more than four inches deep on each side of the car, and in the length of the wheel base which facilitates removing the car from the track by preventing the wedging of the wheels between the rails.



**A View of the Woolery Car, Showing How the Long Wheel Base Prevents Cramping During Removal**

The chrome nickel steel axles run in ball bearings which are attached between the upper wooden side sills and the channel irons below, a construction that gives a low center of gravity as well as strength to the car. The wheels are 20-in. pressed steel, of standard construction; one wheel on each axle is insulated to prevent the operation of electric signals.

An additional feature arises in the brake which is of the automobile type, engaging the tight wheel axle. It is claimed that this type of brake will hold the wheel regardless of the condition of the weather and at the same time leave the side of the car free from the rough projection characteristic of the common type of brake. Provision is made for lifting the car by extending a pipe across each end, these lift handles being three inches above the lower edge of the side sills on the car in order to avoid any likelihood of a man having his fingers pinched between the handle and the track when the car is being turned crosswise of the track.

As the illustration shows, each car is equipped with a safety railing which is built integral with the combined engine housing and seat. This rail above the seat is as wide as the car itself in order to prevent workmen falling off and at the same time allows enough room at the platform level of the car for the loading of rails and timbers from the side. The railing is made of gas pipe.

For ordinary use the car is equipped with the 5 hp. Woolery engine and with the 7½ hp. engine where steep grades and strong winds are encountered. The power is transmitted to a 14-in. double flange pulley on the car axle by a four-inch belt. The car weighs about 800 lb.

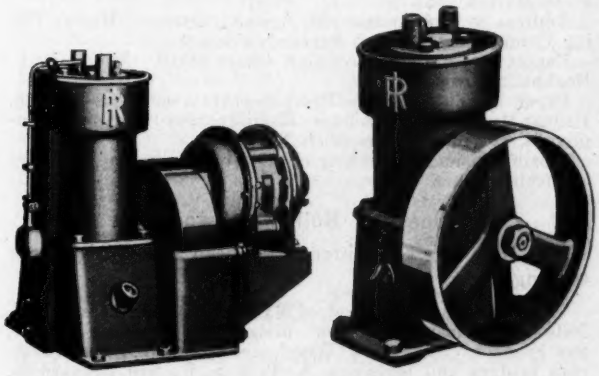
## An Improved Form of Small Air Compressor

IN VIEW of the numerous classes of maintenance work in which air compressing equipment is or can be utilized to advantage when available in proper form, interest attaches to a development in this class of machinery made recently by the Ingersoll-Rand Company, New York. This development consists principally of the incorporation in the earlier type of machine of a constant-level system of lubrication, a constant-speed unloader and an adaptation of the machine to motor drive. Illustrations are shown of both forms of these compressors, the motor outfit, as will be seen, being self-contained with the compressing and power unit and supported on a common base.

The constant-level system of lubrication is designed to eliminate the common tendency of the ordinary enclosed crank case and splash system type of small vertical compressors either to feed too much, with resultant discharging of air containing excess oil, or to feed too little, causing scored cylinders, excess loads and burned-out bear-

ings. The constant-level feed is accomplished by the use of two pet cocks in the oil reservoir of the compressor and the installation of a pan above this reservoir and directly underneath the connecting rods, into which oil is pumped from the reservoir. Under this arrangement, a constant level of oil for lubrication is maintained, regardless of the amount of oil in the reservoir, so long as the reservoir oil is maintained between the high and low level pet test cocks.

The constant speed unloader is designed to control the unloading of the compressor by opening the inlet valve automatically when the air receiver pressure rises above that at which the unloader is set to operate. Under this arrangement when the receiver pressure has fallen the predetermined amount, the unloader releases the inlet valve automatically and allows the compressor to return to work and again build up the pressure. In the case of the electric drive outfit, a centrifugal form of unloader



**Side Views of the Motor Drive and Plain Drive Units**

is used which allows the compressor to start under no load and permits the electric driving motor to come to full speed before the load is thrown on automatically. This device accomplishes the purpose by holding the inlet valve open until the motor has reached full speed, a feature which is essential when automatic start and stop control is used.

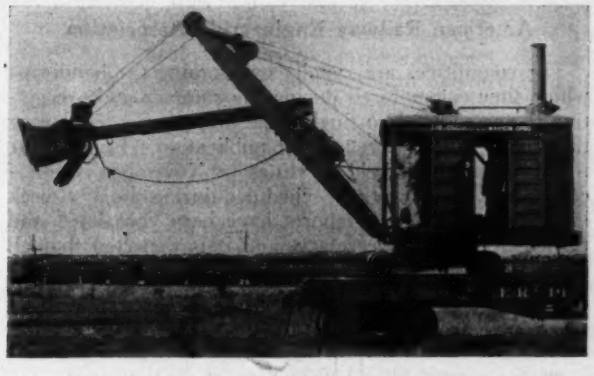
These machines are built in several sizes, the larger sizes being equipped with water jackets of the reservoir type, while the smaller size may also be furnished with the ribbed cylinder for air cooling where intermittent service is required.

## The Osgood Ditcher Improved

FOLLOWING a series of tests in the field, the Osgood Company, Marion, Ohio, is now introducing a ¾-yd. railroad ditcher which embodies several improvements over the Osgood No. 18 machine which it will replace. Like the Osgood No. 18 shovel, this machine is adapted for crane, clam shell or draw line service as well as for shovel service and can be mounted on a standard gage track or upon traction or continuous tread mountings.

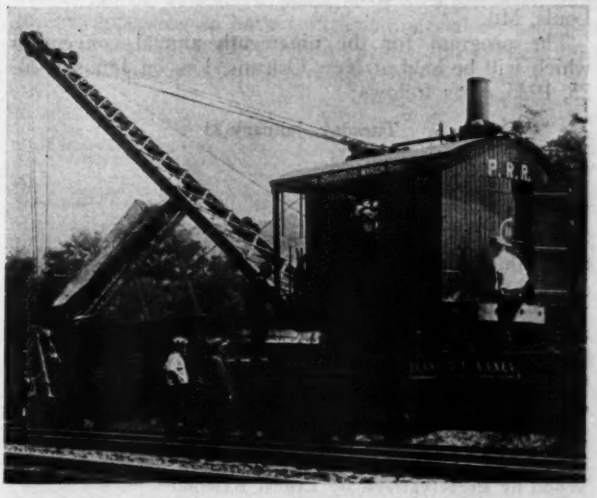
Like the earlier shovel, also, this machine carries the vertical submerged tube boiler with all of the tubes under water to eliminate extreme expansion and contraction; a horizontal hoisting engine designed to reduce vibration to a minimum and a double gear dipper shaft for delivering a positive and equal drive to both sides of the dip per handle, thus eliminating the use of keys. Like the Osgood 18, this machine also has a single unit auxiliary drum capable of being quickly engaged for crane, clam shell or drag line service in order to permit the handling of a bucket with a single line, also a boom hoist so mounted on the top and to the rear of the hoisting engine bed as to permit raising the boom quickly from a horizontal position to an angle of 65 deg. by means of a single lever.

Among the principal improvements over the Osgood 18 ditcher are the following: The hoisting engine exhaust has been increased in size to increase the power about 10 per cent, and the lugs receiving the foot of the boom have been extended six inches, to give an increased



**A Side View of the New Osgood ¾-Yard Ditcher**

digging and dumping radius as well as to afford more room for the auxiliary drum unit and greater clearance for structural booms when the machine is used in crane, clam shell or drag line service. In addition to these improvements, the vertical center shaft has adjusting nuts at both ends to permit adjustment from either top or bottom, and the roller gear is elevated above the surrounding surface of the truck frame sufficiently to allow a full mesh of the swinging pinions from the start, thus equalizing




**Cleaning Ballast on the Pennsylvania With the Improved Osgood Ditcher**

and reducing wear. Other improvements consist of a cast steel boom engine bed, a dipper with full manganese front, a hand hole near the bottom of the water tank to provide a convenient means of cleaning the strainer and bushings of special bronze, which give about three to five times the life of ordinary bronze. The machine is called the Osgood ¾-yd. heavy duty railroad ditcher. Several of these machines are now being used on the Pennsylvania for cleaning ballast.


## American Railway Engineering Association

The committees are rapidly overcoming the handicaps which they encountered during the summer and are getting their reports into final shape preparatory to turning them over to the secretary for publication. Eighteen of the 22 committees held meetings in November, while 4 committees have meetings scheduled during the first week in December. Three reports have been completed and turned over to the secretary, and it is expected that all of the remaining reports will be in his hands prior to January 1.

## The American Wood Preservers' Association

The nominating committee has selected the following officers for the ensuing year whose names appear on a ballot which has been distributed to the members: President, H. S. Sackett, assistant purchasing agent, Chicago, Milwaukee & St. Paul, Chicago; first vice-president, E. J. Stocking, vice-president, Central Creosoting Company, Chicago; second vice-president, S. D. Cooper, assistant manager treating plants, Atchison, Topeka & Santa Fe, Topeka, Kan.; secretary, P. R. Hicks, secretary-manager, Service Bureau, A. W. P. A., Chicago; members executive committee, W. P. Wiltsee, principal assistant engineer, Norfolk & Western, Roanoke, Va.; and E. E. Pershall, vice-president, T. J. Moss Tie Company, St. Louis, Mo.

The program for the nineteenth annual convention which will be held at New Orleans, La., on January 23-25, 1923, is as follows:

### Tuesday, January 23

Convention called to order.
Opening exercises.
Report of secretary-treasurer.
President's address.
Report of Committee on Publications, George H. Hunt, chairman.
Address by a representative of the Association of Railway Executives.
Paper on The Lake Ponchartrain Bridge, by W. J. Kelleher.

### Tuesday Afternoon

Report of Committee on Preservatives, A. L. Kammerer, chairman.
Paper on Methods of Testing the Relative Toxicity of Wood Preservatives, by Miss Audrey C. Richards.
Paper on A Theory on the Mechanism of the Protection of Wood by Preservatives, by Ernest Bateman.
Report of Committee on Utilization and Service, (A) Track, Z. M. Briggs, chairman; (B) Paving Blocks, L. T. Ericson, chairman; (C) Posts—Pressure, W. J. Smith, chairman.
Report of Committee on Cost Accounting, C. C. Schnatterbeck, chairman.

### Wednesday, January 24

Report of Committee on Tropical Hardwoods, Nelson C. Brown, chairman.
Address by Colonel William C. Greeley, U. S. Forester.
Report of Committee on Treatments, (A) Fir, H. E. Horrocks, chairman; (B) Car Material, F. S. Shinn, chairman; (C) Pole—Pressure, C. C. Fritz, chairman; (D) Pole—Non-Pressure, L. L. Hill, chairman.
Report of Committee on Inspection, J. R. Keig, chairman.
Paper on Mexican Railway Ties, by Angel Peimbert.
Paper on Creosoted Water Tanks, by C. R. Knowles.

### Wednesday Afternoon

Report of Committee on Adzing and Boring Ties for Treatment, C. E. Rex, chairman.
Report of Committee on I. C. C. Ruling, Earl Stimson, chairman.
Report of Committee on Steam Treatments, George M. Hunt, chairman.
Report of Service Bureau Board, C. G. Crawford, chairman.
Report of Committee on Properties of Treated Wood, A. R. Joyce, chairman.
Report of Co-operative Committee on Fire Prevention in Highway Bridges, L. T. Ericson, A. W. P. A. representative.
Report of American Engineering Standards Committee, J. H. Waterman, A. W. P. A. representative.

### Wednesday Evening

Joint meeting with Louisiana Engineering Society.

### Thursday, January 25

Report of Committee on San Francisco Bay Marine Piling, F. D. Mattos, chairman.
Address by Col. William G. Atwood, director, Marine Piling Committee, National Research Council.
Report of Committee on Gulf Coast Marine Piling, E. E. Boehne, chairman.
Paper on The Modern Processes of Wood Preservation, Using Mixtures of Sodium Fluoride and Organic Compounds, etc., by Dr. Friedrich Moll.
Closing business, including election of officers and selection of meeting place.

## Bridge and Building Association

The following committees have been appointed for the ensuing year:

The Repair and Renewal of Ballast Deck Trestles: P. N. Nelson, chairman, supervisor bridges and buildings, S. P. San Francisco, Cal.; J. W. Wood, vice-chairman, general foreman bridges and buildings, A. T. & S. F., San Bernardino, Cal.; E. H. Brown, supervisor bridges and buildings, N. P., Minneapolis, Minn.; V. E. Engman, chief carpenter, C. M. & St. P., Montevideo, Minn.; Morris Fisher, supervisor bridges and buildings, S. P., Ogden, Utah; A. H. King, supervisor bridges and buildings, O. S. L., Salt Lake City, Utah; R. B. Robinson, engineer maintenance of way, U. P., Omaha, Neb.; F. E. Taggert, assistant engineer, I. C., Chicago, Ill.; J. L. Winter, master carpenter, S. A. L., Waldo, Fla.

Water Facilities at Stock Yards—Their Construction and Maintenance: H. Heiszenbuttel, chairman, supervisor bridges and buildings, C. & N. W., Norfolk, Neb.; A. M. Swensen, vice-chairman, assistant superintendent bridges and buildings, M. St. P. & S. S. M., Minneapolis, Minn.; F. M. Case, foreman water service, C. & N. W., Belle Plaine, Iowa; E. A. Demars, general foreman plumbing and water service, O. S. L., Salt Lake City, Utah; H. H. Frazer, division foreman, S. P. Dunsmuir, Cal.; C. J. McCarthy, chief carpenter, C. M. & St. P., Aberdeen, S. D.; G. T. Ray, supervisor bridges and buildings, St. J. & G. I., Marysville, Kan.

Methods of Installing or Replacing Culverts, Sewers and Pipe Lines Under Traffic: E. L. Sinclair, chairman, assistant engineer, C. M. & St. P., Marion, Iowa; J. J. Wishart, vice-chairman, supervisor bridges and buildings, N. Y. N. H. & H., Boston, Mass.; E. J. Fraser, supervisor buildings, N. Y. C., Toledo, Ohio; R. C. Henderson, master carpenter, B. & O., Dayton, Ohio; D. L. McKee, master carpenter, P. & L. E., McKee's Rocks, Pa.; Robert McKibben, master carpenter, Pennsylvania, Altoona, Pa.; Norman Rose, supervisor bridges and buildings, S. P., Portland, Ore.; F. L. Wheaton, division engineer, D. L. & W., Buffalo, N. Y.

Heating of Small Passenger Stations: A. I. Gauthier, chairman, supervisor bridges and buildings, B. & M., Concord, N. H.; T. B. Turnbull, vice-chairman, superintendent bridges and buildings, Ann Arbor, Owosso, Mich.; T. W. Bratten, supervisor bridges and buildings, S. P., Oakland Pier, Cal.; Peter Doyle, supervisor bridges and buildings, G. T., Montreal, Que.; R. T. Everett, building inspector, B. & O., Cincinnati, Ohio; A. T. Hawk, engineer buildings, C. R. I. & P., Chicago; C. W. Lentz, supervisor buildings, I. C., Chicago; C. H. Perry, division engineer, C. & N. W., Antigo, Wis.; John W. Porter, special engineer, C. N., Winnipeg, Man.; C. J. Scribner, scale supervisor, C. B. & Q., Chicago.

Tool Equipment for Bridge, Building and Water Service Maintenance Gangs: J. S. Huntoon, chairman, assistant bridge engineer, M. C., Detroit, Mich.; D. T. Rintoul, vice-chair-

man, assistant general bridge inspector, S. P., San Francisco, Cal.; E. K. Barrett, supervisor bridges and buildings, F. E. C., St. Augustine, Fla.; R. E. Caudle, assistant engineer structures, I. & G. N., Palestine, Tex.; E. W. Fair, supervisor bridges and buildings, B. R. & P., Du Bois, Pa.; F. N. Graham, assistant engineer, D. M. & N., Duluth, Minn.; E. P. Hawkins, division engineer, M. P., Osawatomie, Kan.; John Robinson, supervisor bridges and buildings, P. M., Grand Rapids, Mich.; J. J. Taylor, superintendent bridges and buildings, K. C. S., Texarkana, Tex.

Relative Merits of Concrete, Cast Iron and Corrugated Metal Pipe Culverts: A. B. Scowden, chairman, assistant engineer bridges, B. & O., Cincinnati, Ohio; C. S. Heritage, vice-chairman, bridge engineer, K. C. S., Kansas City, Mo.; H. A. Gerst, assistant bridge engineer, G. N., St. Paul, Minn.; F. W. Hillman, division engineer, C. & N. W., Chicago; R. W. Johnson, assistant engineer, C. M. & St. P., Chicago; J. S. Lemond, consulting engineer, Sou., Charlotte, N. C.; W. L. Ratliff, supervisor bridges and buildings, I. C., McComb, Miss.; R. H. Reid, supervisor bridges, N. Y. C., Cleveland, Ohio.

Practicability of a Uniform Painting Program for the Entire Year: H. J. Barkley, chairman, assistant supervisor bridges and buildings, I. C., Carbondale, Ill.; J. B. Gaut, vice-chairman, superintendent bridges and buildings, G. T., Detroit, Mich.; Eldridge E. Candee, supervisor bridges and buildings, N. Y. N. H. & H., New Haven, Conn.; J. B. Clarke, master carpenter, B. & O., Chillicothe, Ohio; J. S. Ekey, supervisor structures, B. & L. E., Greenville, Pa.; J. A. Hanson, supervisor bridges and buildings, C. C. C. & St. L., Mt. Carmel, Ill.; W. C. Harman, bridge inspector, S. P., Tehachapi, Cal.; G. A. Mitchell, superintendent bridges and buildings, G. T., Toronto, Ont., Can.; W. A. Pettis, general supervisor bridges and buildings, N. Y. C., Rochester, N. Y.; L. K. Sorenson, chief carpenter, C. M. & St. P., Harlowtown, Mont.

# Watch the Dry Cells

DURING the last four years the Illinois Central System purchased 262,910 dry cells at a cost of $71,156.45. This represents an expense of $58.13 for each working day. The annual cost of these dry cells, capitalized at 6 per cent, equals the interest on an investment of $296,487.

Much of this expense is due to lack of care in handling and using the cells. Few users of dry cells realize that they require considerable care and that large numbers are ruined or badly damaged through improper handling and storage, even before they are placed in use.

Dry cells should never be stored with the terminal end down, nor should the cells be laid on the side; they should always be stored with the bottom down. In receiving dry cells for storage, those in charge should mark the date of receipt on each cell, issuing them in the order of receipt, the oldest ones first.

Dry cells should be stored in a dry, cool place and never near radiators or steam pipes, as excessive heat will wear the cells out more quickly than continuous use in actual service. On the other hand, they should never be allowed to freeze.

Old, weak cells should never be used in the same battery with fresh cells, as the strength and life of the battery will be only that of the weakest cell.

In using an ammeter or battery tester, touch the terminals firmly, but remove the contact as quickly as the reading is obtained. Prolonged contact will short-circuit the cell and run down its strength quickly.

Many motor car operators have the erroneous idea that seven or eight dry cells are necessary to provide an efficient spark. Four or five cells are sufficient for any motor car battery and will provide just as good a spark as eight cells, with about three times the life of the eight-cell battery. The five-cell battery has an added advantage in the fact that it will not burn out the coils and contact point so quickly as one with a greater number of cells, thus actually furnishing more reliable ignition.—From the Illinois Central Employees' Magazine for October, 1922.

# The Material Market

A GENERAL survey of the material market indicates little change in the prices of commodities other than decreases in scrap and slight increases in some lumber items. The consumption of steel generally shows no diminution, although new buying is still slack in view of the uncertainty as to prices for the first quarter of the new year. The demand for bolts, spikes and tie plates is somewhat more active, but is confined generally to small lots. All mills are well booked and show little disposition to meet demands for early shipments. Carnegie not accepting orders for more prompt delivery than six to eight weeks. The fact that most inquiries made are for earlier delivery is one indication of the demand. It appears that supply and demand will be the arbiter in the present test of buyer and seller strength.

The country generally has no stocks of steel and with the labor and car scarcity the mills are not likely to increase the present rate of output. The production of all commodities including lumber has been affected by car shortages, pointing to the possibility of a general upward trend in prices with a continuance of the car shortage.

| | Prices Per 100 Pounds | | | |
|---|---|---|---|---|
| | October 20 | | November 20 | |
| | Pittsburgh | Chicago | Pittsburgh | Chicago |
| Track spikes | $2.75 to $2.85 | $2.85 to $3.00 | ... $2.75 | $2.85 to $3.00 |
| Track bolts | ... 4.50 | 3.85 to 4.00 | $3.85 to 4.50 | 3.85 to 4.00 |
| Angle bars | ... 2.75 | ... 2.75 | ... 2.75 | ... 2.75 |
| Tie plates, steel | ... 2.35 | ... 2.35 | ... 2.35 | ... 2.35 |
| Tie plates, iron | ... ... | ... 2.50 | ... ... | ... 2.50 |
| Plain wire | 2.45 ... | 2.79 ... | ... 2.45 | ... ... |
| Wire nails | 2.70 ... | 3.04 ... | ... 2.70 | ... ... |
| Barbed wire, gal. | 3.35 ... | 3.69 ... | ... 3.35 | ... ... |
| C. I. pipe, 6 in. or larger, per ton | ... ... | ... 51.50 | ... ... | 51.20 to 52.20 |
| Plates | 2.00 to 2.25 | 2.10 to 2.30 | ... 2.00 | ... 2.20 |
| Shapes | 2.00 to 2.25 | 2.10 to 2.25 | ... 2.00 | ... ... |
| Bars | 2.00 to 2.15 | 2.00 to 2.10 | 2.00 to 2.60 | 2.00 to 2.20 |
| Open hearth rail per gross ton f. o. b. mill | | | | 43.00 |

The prices of scrap shown in the table below indicate marked decreases over those quoted last month. The consumer buying of scrap appears to be at a minimum with buyers appearing to have sufficient material on order to take care of their early requirements, and hesitancy to add to their stocks until inventory has been taken.

| | October | November |
|---|---|---|
| Relaying rails | $27.50 to $32.00 | $32.00 to $35.00 |
| Rerolling rails | 20.50 to 21.00 | 18.00 to 18.50 |
| Rails less than 3 ft. long | 22.00 to 22.50 | 19.00 to 19.50 |
| Frogs and switches cut apart | 18.50 to 19.00 | 17.00 to 17.50 |
| | Per Net Ton | |
| No. 1 railroad wrought | 17.50 to 18.25 | 15.50 to 16.00 |
| Steel angle bars | 18.50 to 19.00 | 17.00 to 17.50 |

In general, prices in the lumber market are continuing at the high level established by the steady demand from practically all quarters, although an upward tendency appears in the case of numerous southern hardwood items. Slight increases also have been noted in yellow pine, production of which has increased to about 92 per cent of normal.

| Southern Mill Prices | | |
|---|---|---|
| Flooring, 1x4, B and B, flat | $49.55 | $50.77 |
| Boards, 1x8, 14 and 16, No. 1 | 36.25 | 40.00 |
| Dimension, 2x10, 16, No. 1, common | 30.38 | 31.42 |
| Dimension, 2x4, 16, No. 1 | 26.00 | 32 06 |
| Timbers, 4x4 to 8x8, No. 1 | 20.00 | 28.91 |
| Timbers, 3x12 to 12x12, No. 1 | ..... | 36.75 |
| **Douglas Fir Mill Prices** | | |
| Flooring, 1x4, No. 2, clear, flat | 38.00 | 38.00 |
| Boards, 1x6, 6 to 20, No. 1, common | 14.00 | 14.00 |
| Dimensoin, 2x4, 16, No. 1, common | 20.50 | 20.50 |
| Dimension, 2x10, 16, No. 1, common | 21.50 | 21.50 |
| Timbers, 6x6 to 8x8, No. 1, common | 17.00 | 18.00 |
| Timbers, 10x10 to 12x12, rough | 18.00 | 20.00 |

Prices for Portland cement continue steady. The recent prices issued by the Universal Portland Cement Company indicate changes arising rather from corrections in freight rates than from any conditions of the market.

| | | | |
|---|---|---|---|
| Chicago | $2.20 | Duluth | $2.14 |
| Cincinnati | 2.51 | Milwaukee | 2.37 |
| Davenport | 2.43 | Minneapolis | 2.39 |
| Detroit | 2.47 | Pittsburgh | 2.24 |

# General News

**Secretary Denby** of the Navy has written to the Interstate Commerce Commission recommending that the names of towns be painted in large letters on the roofs of railroad stations for the guidance of aviators, as they are obliged frequently to fly very low for the purpose of identifying the towns over which they pass.

**The Virginian** has recently placed in service for use on its lines a new wrecking crane which it is claimed has the distinction of being the largest machine of the kind ever built. Heretofore, it is said, that the largest railroad wrecking crane was a 160-ton machine having a maximum capacity of 320,000 lb. with all out-riggers in service. As compared with this, the new crane has a capacity on the main hoist of 400,000 lb. at a 17-ft. 6-in. radius with all out-riggers in service.

**The Temiskaming & Northern Ontario** is extending its line from its junction with the National Transcontinental at Cochrane, Ont., to James Bay. The first 70 miles of this line is now under construction and surveys are being made for its extension to the estuary of the Moose River at the south end of James Bay. The maximum gradients are 0.4 per cent southbound and 0.6 per cent northbound, with a maximum curvature of four degrees.

**The railroads of France** have decided to electrify over 5,000 miles of their tracks. Two hundred locomotives will be purchased for operation over this zone, 120 of which have already been ordered. While the mechanical parts and all but a few of the motors for these 120 locomotives are to be manufactured by European concerns, the complete control equipment will be built by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

**While the orders** placed thus far this year for locomotives and freight cars show the railroads to be using all available resources to increase facilities, the new equipment bought will not result in an equivalent net increase in the amount of equipment in service. The average number of locomotives retired from service annually in the ten years ending with 1921 was 1,615, which is only 177 less than the total number ordered thus far this year. The average number of freight cars scrapped and retired from service annually in the ten years ending with 1921 was 76,760, which is only 46,193 less than the total number of freight cars ordered thus far this year.

**The railroad valuation work** on which the Interstate Commerce Commission has been engaged during the past eight years is now rapidly coming to a close. Up to August 31 504 accounting section reports have been served, covering 134,272 miles, or 54.14 per cent, of the inventoried main line mileage; 584 land section reports, covering 132,067 miles, or 53.25 per cent, of the total, and 593 engineering section reports, covering 158,730 miles, or 68.03 per cent, of the total. From now on the work will primarily be focused on the roads having annual revenues of $25,000,000 or over. It is expected that by the end of the fiscal year, June 30, 1923, underlying reports will have been issued on all except six of these roads.

**A hearing on the application** of the Southern Pacific to retain control of the Central Pacific through lease and stock ownership pending the completion of the commission's consolidation plan was begun before Commissioners Meyer and Potter of the Interstate Commerce Commission at Washington on November 21. The application being vigorously contested by the Union Pacific on the ground that jurisdiction of the matter is still with the United States court, which was directed to carry out the mandate of the Supreme Court that the two companies be separated. A large number of commercial organizations and state and local authorities have taken sides in the controversy and were represented at the hearing.

**Following close upon the Rock Island's celebration** of its seventieth anniversary on October 10, the suggestion has been made that the railroads of North America endorse the idea and begin now to prepare plans for a railroad centennial to represent the combined energies of every American railroad. The statement is made that less than six years remain until the hundredth anniversary of July 4, 1828, when Charles Carroll, only living signer of the Declaration of Independence, drove home the spike that marked not only the beginning of the Baltimore & Ohio, but of American railroads. Since that time the transportation system of the United States and Canada has expanded to a mileage of approximately 300,000, which is more than in all Europe, more than four times that in all Asia, and more than ten times that in Great Britain. A celebration of this kind, it is suggested, affords an exceptional opportunity for the railroads to engage the attention of the public in a way that will mean much to them in the future.

**Revenue freight car** loading continued to increase during the week ended on October 28 and was over the million mark for the second time this year. The total, 1,014,480, was also only 4,059 cars less than the record for a week established in October, 1920, and in all districts except the Pocahontas and the North Western, the loading was in excess of that for the corresponding week of 1920. The total loading for the week was 10,721 in excess of that for the previous week, 63,096 greater than that for the corresponding week of last year, and 33,238 greater than that for the corresponding week of 1920. During the first 40 weeks this year more cars were loaded with merchandise and miscellaneous freight than ever before in the history of the railroad. For the week ended October 15 the railways were unable to furnish 156,309 freight cars for which shippers had made requisitions, which figure reduced by 4,275, the surpluses of cars in different parts of the country, left a net "car shortage" of 152,034, the largest car shortage ever reported.

**Complete statistics issued** by the Interstate Commerce Commission concerning railway accidents in 1921 show that while the number of fatalities resulting from railway accidents of all kinds was less than for any year since 1889, a great increase has occurred in the number of fatalities arising from automobile accidents at highway crossings. The number of fatalities occurring from this source in 1921 was 1,702, which is 554 more than the total fatalities to passengers and employees arising from train operation. Of these casualties, 80 per cent involved occupants of automobiles and motor trucks, as compared with 59 per cent in 1917. The report further shows that a large increase is occurring in the number of accidents to trespassers on railway property. The total number of trespassers killed in 1921 was 2,481, as compared with 2,166 in 1920. The total number of persons killed in 1921 from railway accidents of all kinds was 5,996, as compared with 6,928 for 1920 and 6,997 for 1919. Of this number 116 were passengers and persons carried on trains, as compared with 169 in 1920. The total number of employees reported killed in train service accidents in 1921 was 1,032, as compared with 1,885 in 1920.

# Personal Mention

## General

**F. A. Russell,** formerly office engineer in the valuation department of the Missouri, Kansas & Texas, with headquarters at Parsons, Kan., has been appointed professor of railway engineering at the University of Kansas.

**W. A. Baldwin,** manager of the Ohio region of the Erie, with headquarters at Youngstown, Ohio, and for several years in the maintenance of way and engineering departments, has been promoted to vice-president in charge of operation of the system, with headquarters at New York. Mr. Baldwin was born at Elmira, N. Y., on July 26, 1876, and was graduated from Cornell University in 1896. He entered railway service the same year as a chainman on the Erie, was promoted to rodman in May, 1899, and some time later became assistant engineer. From March, 1902, to September, 1903, he served as trainmaster, being appointed division engineer on the latter date, which position he retained until 1909, when he was again appointed trainmaster. In December, 1910, he was promoted to superintendent of the Chicago and Lima division, and subsequently was promoted to general superintendent, Lines East of Salamanca. He was transferred to the Lines West in 1917, with headquarters at Youngstown, and in June, 1918, was appointed transportation assistant. A month later he was apointed general manager, and so served until April, 1920, when he was appointed manager of the Ohio region, the position he held at the time of his recent promotion.

W. A. Baldwin

**John S. Worley,** consulting engineer of New York City, has been appointed to head the newly organized department of transportation of the University of Michigan with the title of Professor of Transportation and Railroad Engineering, this department having been established on October 27 by the Board of Regents of the university. Mr. Worley was born in Jackson County, Mo., on April 19, 1876, and received his education at Odessa (Mo.) College and at the University of Kansas. He entered railway service as an assistant engineer on the Kansas City, Mexico & Orient in 1900, later serving as assistant engineer of construction of the Arkansas & Choctaw, a subsidiary of the St. Louis-San Francisco. From 1901 to 1905, he was assistant engineer of construction and assistant chief engineer of the St. Louis & North Arkansas and in 1905 was appointed engineer in charge of construction of the Toledo, Urban and Interurban. From 1904 to 1908, he was associated with Riggs & Sherman, consulting engineers at Toledo, Ohio, in the capacity of principal assistant engineer of design and construction, and in 1908, with H. E. Riggs and M. W. Thompson, participated in the Central of Georgia income bond case, having charge of engineering work which included examination of the accounts and certain valuations. He was a member of the firm of Worley & Black, consulting engineers at Kansas City, Mo., from 1909 to 1914, and at the same time was also retained in a consulting capacity on various other public utility work. On May 1, 1913, he was named a member of the engineering board of the Division of Valuation of the Interstate Commerce Commission and was in direct charge of the Western district. He was retained as consulting engineer of the Bureau of Valuation from January 1, 1920, to July, 1921.

John S. Worley

**J. W. Kendrick,** private consultant in matters pertaining to railroad construction, operation and maintenance, Chicago, and an engineer by education and training, has been selected as chairman of the board of directors of the International-Great Northern. Mr. Kendrick was born on October 14, 1853, at Worcester, Mass., and was graduated from Worcester Polytechnic Institute in 1873. He entered railway service in 1878 as a levelman on a construction party on the Yellowstone division of the Northern Pacific and was engaged on the location of the Yellowstone and Missouri divisions of that road until 1880, when he was promoted to engineer in charge of construction of the above divisions. In 1883 he became chief engineer of the St. Paul & Northern Pacific (Northern Pacific) in charge of the construction of a line connecting Staples, Minn., Brainerd, Minneapolis and St. Paul, with the necessary terminals and shops. From 1888 to July, 1893, he served as chief engineer of the Northern Pacific and its leased lines, and on the latter date was made general manager for the receivers of the Northern Pacific and later of the reorganized company. On February 1, 1899, he was promoted to vice-president in charge of operation, which position he held until June 5, 1901, when he became vice-president in charge of operation of the Atchison, Topeka & Santa Fe. In June, 1911, he established a private practice in Chicago as consultant in railway matters, in which capacity he was serving at the time of his recent election.

J. W. Kendrick

## Engineering

**W. N. Boyd** has been appointed chief engineer of the Port Huron & Detroit, with headquarters at Bay City, Mich.

**L. L. Shirey,** formerly an assistant engineer of the Cleveland, Cincinnati, Chicago & St. Louis, has been appointed a designing engineer of the same road, with headquarters at Cincinnati, O.

**B. B. Shaw,** division engineer of the Chicago, Rock Island & Pacific, with headquarters at Little Rock, Ark., has resigned to become chief engineer of the Cuba Railway, with headquarters at Camaguay, Cuba.

**Arthur B. Ilsley,** engineer of bridges of the Southern, with headquarters at Charlotte, N. C., has resigned to become associated with the recently organized firm of engineer appraisals, Rice & Ilsley, Inc., with headquarters at Boston, Mass.

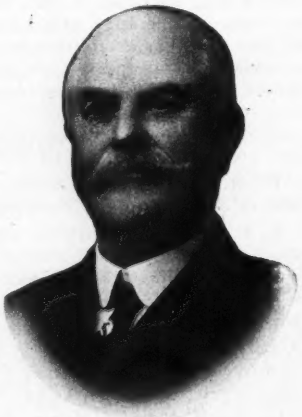
**Irwin H. Schram,** regional engineer of the Hornell region of the Erie, with headquarters at Hornell, N. Y., has been transferred to the Chicago region, with headquarters at Chicago to succeed J. R. Sexton, who has been appointed division engineer at Huntington, Ind.

**William C. Baisinger,** whose promotion to engineer of the Eastern district of the Atchison, Topeka & Santa Fe, with headquarters at Topeka, Kan., was noted in the November issue, was born on November 8, 1885, in Indiana. He was educated at Purdue University and served as a masonry inspector and rodman on the Atchison, Topeka & Santa Fe during 1907 and 1908. During 1909 and 1910, he was an assistant engineer and in 1911 and 1912 he again served as assistant engineer on the same road. In 1913, Mr. Baisinger was promoted to division engineer, which position he held until 1917 when he was promoted to office engineer, in the office of the chief engineer of the Eastern lines at Topeka, Kan., later serving again as division engineer. In 1921, he was made a roadmaster, in which capacity he was serving at the time of his recent promotion.

**J. W. Stone,** assistant valuation engineer of the Pennsylvania System, with headquarters at Philadelphia, Pa., has been promoted to valuation engineer, with the same headquarters, succeeding **C. A. Preston,** deceased. Mr. Stone was born in Philadelphia and was educated at Treemont Seminary, Norristown, Pa. Immediately following the completion of his studies at Treemont, he entered railway service as a rodman in the engineering department of the Pennsylvania, where he remained in various engineering capacities for four and one-half years. He was then transferred to the maintenance of way department where he served successively as transitman, assistant supervisor, supervisor and division engineer at various points on the lines east of Pittsburgh and Erie. On May 15, 1915, Mr. Stone was appointed assistant valuation engineer of the Pennsylvania Railroad, Lines East, and served in that capacity until his present promotion as noted above.

J. W. Stone

**F. M. Bisbee,** chief engineer of the Atchison, Topeka & Santa Fe, Western lines, with headquarters at Amarillo, Tex., whose retirement was reported in the November issue, was born on September 27, 1853, at Brunswick, Me., and received his education in civil engineering at the University of Maine. He entered railway service in 1878 as a transitman on the Atchison, Topeka & Santa Fe, and later entered the employ of the Mexican Central as superintendent of construction, where he was subsequently promoted to resident engineer of maintenance. In 1883 he returned to the Atchison, Topeka & Santa Fe in charge of construction and for some months in 1887 served with the Colorado Midland, after which he again returned to the Santa Fe. He was appointed roadmaster on the Gulf, Colorado & Santa Fe, with headquarters at Cleburne, Tex., in December, 1890, and two years later entered the service of the Lake Shore & Michigan Southern, but soon returned to the Gulf, Colorado & Santa Fe, at Cleburne, as superintendent of track, bridges and buildings. In August, 1896, he entered the service of the St. Louis & San Francisco as superintendent of track, bridges and buildings and three years later became general and chief engineer of the Tennessee Central, which position he held until January, 1901, whn he became general manager of the Los Angeles Land & Water Company. He was employed as an engineer by B. Lantry & Sons, railroad contractors, at Ft. Madison, Ia., from 1903 to 1904, but returned to the Santa Fe in June, 1904, as engineer of the Western lines, with headquarters at La Junta, Colo. He was promoted to chief engineer of the Western lines, with headquarters at Amarillo, Tex., in May, 1913, and was holding this position at the time of his retirement.



F. M. Bisbee

**M. C. Blanchard,** whose promotion to chief engineer of the Atchison, Topeka & Santa Fe, Western lines, with headquarters at Amarillo, Tex., was noted in the November issue, was born at Hamlin, Kan., on October 17, 1879, and graduated from Kansas University in 1902. He entered railway service on June 13, 1902, with the Atchison, Topeka & Santa Fe and served in various capacities in the engineering department until June 1, 1907, when he was promoted to division engineer. From January 1, 1909, to June 1, 1910, he was roadmaster, on the latter date being promoted to assistant engineer, which position he held until January 1, 1911, when he was promoted to division engineer. On May 1, 1913, he was promoted to office engineer and on July 1, 1915, was promoted to engineer of the Eastern district, with headquarters at Topeka, Kan. Mr. Blanchard was appointed superintendent of the Missouri division with headquarters at Marceline, Mo., on March 1, 1918, and on February 1, 1920, was transferred to the Illinois division, with headquarters at Chillicothe, Ill., at which point he was located at the time of his recent promotion.

**W. G. Arn,** assistant engineer maintenance of way of the Illinois Central and the Yazoo & Mississippi Valley, with headquarters at Chicago, has been promoted to assistant chief engineer of the Chicago Terminal Improvement of the Illinois Central, with the same headquarters. Mr. Arn was born on February 7, 1877, at Terre Haute, Ind., and graduated from the Rose Polytechnic Institute in 1897. He entered railway service as a rodman on the Louisville and Nashville in September, 1897, and was promoted to masonary inspector in October, 1898, which position he held until 1899, when he was appointed building inspector. In November, 1900, he was promoted to assistant engineer, which position he held until April, 1905, when he was promoted to roadmaster. In March, 1906, he became superintendent and engineer of the Southern Bitulithic Company at Nashville, Tenn., which position he held until October, 1906, when he became an assistant engineer on the Missouri Pacific, with headquarters at St. Louis, Mo. In March, 1907, he entered the service of the Illinois Central as an assistant engineer in charge of the construction of the Birmingham terminal at Birmingham, Ala., which position he held until April, 1908, when he was promoted to assistant engineer of the Birmingham division, with headquarters at Corinth, Miss. In September, 1909, he was placed in charge of the reconstruction of the passenger terminal at Louisville, Ky., and in June of the following year was transferred to the general office at Chicago, where he was assigned to special work, including valuation. In August, 1912, he was placed in charge of the construction of the new passenger terminal and subway at Memphis, Tenn., which position he held until November, 1914, when he was appointed roadmaster with headquarters

W. G. Arn

at Mattoon, Ill. In June, 1916, he was promoted to assistant engineer of maintenance of way on the Illinois Central and Yazoo & Mississippi Valley, with headquarters at Chicago, which position he was holding at the time of his recent promotion. Mr. Arn enlisted in the United States Army in February, 1917, and in May of the same year became captain of the 13th Engineers. While in France he was promoted to major and later to lieutenant colonel. On his discharge in June, 1919, he resumed his duties with the Illinois Central.

## Track

**B. Esbenson** has been appointed general roadmaster of the Salt Lake division of the Union Pacific, with headquarters at Salt Lake City, Utah.

**J. S. Mason,** section foreman on the Mobile & Ohio, at Tupelo, Miss., has been promoted to roadway supervisor, with headquarters at Okolona, Miss., succeeding **J. T. Hamrick,** resigned.

**James S. Mason,** section foreman on the Mobile & Ohio, has been promoted to supervisor of track, with headquarters at Oklona, Miss. Mr. Mason was born at Bonneville, Miss., on October 26, 1885, and entered railway service in September, 1910, as a section laborer, on the Mobile & Ohio. He was promoted to apprentice foreman in 1911 and in August, 1912, was promoted to section foreman, the position he held at the time of his promotion as noted above.

**Eugene Belch,** whose promotion to roadmaster of the Gila district of the Southern Pacific, Pacific System, with headquarters at Gila, Ariz., was noted in the November issue, was born on June 21, 1879, in Clay County, Arkansas. He entered railway service in October, 1897, as a section laborer on the Missouri, Kansas & Texas of Texas and from November, 1900, to October, 1908, was a section laborer and extra gang foreman on the St. Louis Southwestern of Texas. He entered the service of the Southern Pacific on December 28, 1908, as a section foreman and continued in that capacity and as extra gang foreman until his present promotion.

**Fred W. Broerman,** section foreman on the Chicago, Ottawa & Peoria, has been promoted to roadmaster, with headquarters at Ottawa, Ill. He was born at Westfalen, Germany, on October 8, 1863, and entered railway service as a laborer on January 13, 1881. From April 1, 1885, to July 1, 1910, he was successively a section foreman on the Peoria, Decatur & Evansville and on the Illinois Central, the latter road having purchased the Peoria, Decatur & Evansville in 1901. On July 1, 1910, he was appointed a section foreman on the Chicago & Alton and on April 9, 1917, became a section foreman on the Chicago, Ottawa & Peoria, where he was located at the time of his promotion.

**Frank H. Rothe,** whose promotion to supervisor of track of subdivision No. 13½ of the Pittsburgh division of the Pennsylvania System, with headquarters at Pittsburgh, Pa., was noted in the November issue, was born on October 5, 1890, at Philadelphia, Pa., and attended Drexel Institute from 1908 to 1912. He entered railway service December 4, 1912, with the Pennsylvania Railroad as a chainman at Oil City, Pa., and on February 1, 1913, was promoted to rodman. From November 21, 1916, to July 16, 1917, he served as transitman at Philadelphia, and on the latter date was promoted to assistant supervisor at Barnesboro, Pa., in which capacity he has served at various places until his recent promotion.

**George Ehrenfeld,** supervisor of track on the Pennsylvania Railroad on special duty at Pittsburgh, Pa., since 1914, has retired from active railway work at the age of 70. Mr. Ehrenfeld was born at Lilly, Pa., on October 17, 1852, and entered railway service as a track laborer at Gallitzen, Pa., at the age of 15. When 18 years old he was promoted to foreman in charge of the Gallitzen tunnel section and one year later was promoted to foreman of a "floating gang." In 1873 he was made conductor and foreman of a combined work and wreck train, also at Gallitzen, where he remained until 1886, when he reentered the track department as a supervisor. Except for the five years, 1886 to 1891, when he was located on the Cambria and Clearfield division, Mr. Ehrenfeld was main line supervisor at Gallitzen for 23 years, when he was made special supervisor with headquarters at Pittsburgh, the position that he held at the time of his retirement. Several interesting sidelights on his railway work are that 17 out of 24 successive annual track inspection prizes were awarded him and that he designed and developed three labor saving machines, now in regular use on the Pennsylvania. These devices are a ballast spreader, a ballast screen and a power driven track sweeper, descriptions of which have appeared in past issues of the **Railway Maintenance Engineer.**

**C. W. Jenkins,** whose promotion to supervisor of track on the Akron division of the Pennsylvania, with headquarters at Akron, Ohio, was noted in the November issue, was born at New Castle, Pa., on November 1, 1887, and attended Carnegie Technical School from September 15, 1908, to May 1, 1909. He entered railway service on March 1, 1905, as a chainman on the Erie and Ashtabula division of the Pennsylvania, with headquarters at New Castle, Pa., and on September 15, 1908, became a draftsman in the office of the chief engineer maintenance of way at Pittsburgh, Pa. From May 1, 1909, to July 1, 1917, he was an assistant in the engineering corps of the Western division at Fort Wayne, Ind., and on the latter date was transferred to the Cleveland and Pittsburgh division, with headquarters at Cleveland, Ohio. He was promoted to assistant division engineer of the Marietta division, with headquarters at Cambridge, Ohio, on February 15, 1918, and on March 1, 1921, was apponted assistant supervisor on the Panhandle division at Carnegie, Pa., which position he held until March 1, 1922, when he was appointed an assistant in the engineering corps of the Panhandle division at Pittsburgh, Pa. He was made assistant supervisor on the Pittsburgh division on August 15, 1922, which position he held at the time of his promotion as noted above.

## Bridges and Buildings

**J. A. Morford** has been appointed supervisor bridges and buildings of the Los Angeles division of the Union Pacific, with headquarters at Los Angeles, Cal., succeeding **W. C. Frazier,** who has been appointed bridge, fire and sanitary inspector, with the same headquarters.

## Obituary

**H. J. Simmons,** general agent of the El Paso & Southwestern, with headquarters at El Paso, Tex., and for several years chief engineer of that road, died in that city on October 16. Mr. Simmons was born on July 17, 1869, at Adairville, Ky., and entered railway service as a rodman on the Huntsville & Monte Sano in April, 1888. From 1889 to 1893, he was engaged in private practice and from August, 1893, to August, 1895, was civil engineer for the Railroad Commission of Texas. During the next seven years he was engineer and superintendent of the Galveston, La Porte & Houston and the Arizona & New Mexico, respectively, at the close of which in April, 1902, he entered the employ of the El Paso & Southwestern as chief engineer. He later held the positions of general superintendent and of general manager, resigning from the latter position on September 1, 1915. In March, 1920, he was appointed general agent.

**E. B. Taylor,** who retired two years ago as a vice-president of the Pennsylvania, Lines West, died on November 8 at Pittsburgh. Mr. Taylor was born at Riverton, N. Y., in 1850, and graduated from Haverford College in 1689. The following year he received a degree in civil engineering from the Polytechnic College of Pennsylvania and immediately entered the service of the Pennsylvania Railroad as a clerk in the superintendent's office at Harrisburg, Pa. Two years later he was promoted to supervisor and, shortly thereafter, to assistant engineer of the Middle division. Later he was transferred to the Pittsburgh division and later was promoted to superintendent of the Lewistown division. He was then transferred to the West Penn division. He then went to the Pittsburgh, Cincinnati, Chicago & St. Louis in a similar capacity and subsequently was promoted to general superintendent Northwest system. In 1890 he became general superintendent of transportation of all the Pennsylvania, Lines West. The following year he was elected fourth vice-president and was later advanced to third, and then second vice-president in charge of accounting and treasury.

# Construction News

**The Atlantic Coast Line** has awarded a contract to Fairbanks, Morse & Co., Chicago, for the construction of a 150-ton concrete coaling station at Jesup, Ga.

**The Baltimore & Ohio** has contracted with the Seaboard Construction Company, Philadelphia, Pa., to remodel second-hand girders and erect a new superstructure for the bridge carrying its tracks across Stone Coal Creek, Macpelah Junction, W. Va., to consist of a 55-ft. through plate girder span.

This company has placed a contract with the McClintic-Marshall Company for the fabricttion of approximately 2,500 tons of structural steel required in connection with its program for bridge renewals during 1923.

This company has entered into a contract with the John S. Metcalf Company, of Chicago, for the preparation of plans and specifications of new grain elevator facilities at Locust Point, Baltimore, Md., to replace two elevators destroyed by fire on July 2. Tentative plans call for a steel and concrete elevator of 3,000,000 bu. capacity, capable of being increased to 8,000,000 bu. The plans include complete facilities for drying and cleaning grain, and for unloading from boats. The elevator will be constructed on the water's edge with galleries and belt conveyors reaching eight berths, four of which will be located on an exclusive grain loading pier, to be constructed for that purpose, the other four on a two-story merchandise pier already in use.

**The Bangor & Aroostook** has awarded a contract to the Howlett Construction Company, Moline, Ill., for the construction at Squa Pan, Me., of a coaling station with 50 tons' ground and a 25 tons' overhead storage.

**The Buffalo Creek & Gauley** has awarded a contract to the Phoenix Bridge Company, Phoenixville, Pa., for six steel bridges.

**The Canadian National** has awarded contracts to Symes & Company, Fort William, Ont., for the laying of 12,500 ft. of 8-in. water pipe at Mount, Ont.; to the Jamieson Construction Company, Edmonton, Alta., for the laying of 6,500 ft. of 8-in. water pipe at North Battleford, Sask.; to J. D. McArthur, Winnipeg, Man., for a dam at Rivers, Sask.; to the Northern Construction Company, Winnipeg, for a water supply system at Pattee, Sask., and to P. W. Graham, Moose Jaw, Sask., for the construction of an addition to the office building at Saskatoon, Sask.

**The Chicago & North Western** has been ordered by the Board of Railroad Commissioners of South Dakota to construct a station not less than 16 ft. by 24 ft. at Oral, S. D.

**The Chicago, Burlington & Quincy** has awared a contract to Edgar Otto, Downers Grove, Ill., for the installation of a pumping plant, intake well, suction piping and intake piping for a reservoir at Galesburg, Ill.

**The Chicago, Milwaukee & St. Paul** has been ordered by the Board of Railroad Commissioners of South Dakota to construct a station at least 24 by 70 ft. at Draper, S. D.

**The Chicago, Rock Island & Pacific** has awarded a contract to the Railroad Water & Coal Handling Company, Chicago, for the construction of a water treating plant of 25,000 gal. hourly capacity at Manly, Iowa. This company closed bids on November 14 for a frame icehouse at Eldon, Ia., to cost approximately $12,000. This company, with the Vicksburg, Shreveport & Pacific, has been ordered by the Louisiana Public Service Commission to build sheds over the train platforms at the joint station at Ruston, La. This company has awarded a contract to the T. S. Leake Construction Company, Chicago, for a one-story addition, 40 ft. by 275 ft., to its machine shop and for the construction of a woodworking mill, 60 ft. by 128 ft., at Cedar Rapids, Iowa.

**The Chicago, St. Paul, Minneapolis & Omaha** has awarded a contract to the Ogle Construction Company, Chicago, for a 150-ton frame coaling station at Emerson, Neb.

**The Chicago Union Station Company** has awarded a contract to the George A. Fuller Company, Chicago, for the granite and stone work for the main building of the Union Station and has awarded a contract to the R. C. Wieboldt Construction Company, Chicago, for the construction of a signal tower. This company, reported in the October issue as closing bids for the excavation for permanent station tracks between Van Buren and Harrison streets, has awarded the contract to W. J. Newman Construction Company, Chicago. This company, also reported in the October issue as receiving bids for the widening of Canal street, Chicago, from Harrison street, 225 ft. north, has awarded the contract to Paschen Brothers Company, Chicago.

**The Colorado, Columbus & Mexican,** through its attorney, John Phillips, of Wichita Falls, Texas, has filed a petition with the Interstate Commerce Commission for a certificate authorizing the construction of 550 miles of electric railroad in New Mexico, Texas and Arizona, including a main line from Columbus, N. M., on the Mexican border, to Farmington on the Denver & Rio Grande, with various branches including one to El Paso, Texas. The company has been incorporated in New Mexico with an authorized capital stock of $5,000,000 and asks the commission for authority to issue $20,000,000 of bonds to be sold at not less than 85.

**The Gulf Coast Lines** will construct a six-stall concrete roundhouse at Brownsville, Tex., to cost approximately $50,000.

**The Illinois Central,** which was reported in the October issue as intending to improve its coal handling facilities at McComb, Miss., has awarded a contract to the Railroad Water & Coal Handling Company, Chicago, for a 300-ton coaling station.

This company has awarded a contract to W. J. Zitterel & Company, Webster City, Iowa, for the construction of a water station at Calumet, Iowa, and has awarded a contract to Joseph E. Nelson & Sons, Chicago, for a 100,000-gal. creosoted water tank at Herrin, Ill. The work will cost approximately $15,000. This company will also construct two yard tracks 5,000 ft. long at Broadview, to cost $22,000; two car repair tracks at Clinton, Ill., to cost $16,000 and a wye track 3,000 ft. long at Blackford, Ky., to cost $13,000.

**The Kansas City Southern** has been ordered by the Louisiana Public Service Commission to build a station at De Quincy, Ia.

**The Los Angeles & Salt Lake** has been authorized by the Interstate Commerce Commission to construct a thirty-two mile branch line from a connection with its main line at Lund, Utah, in a southeasterly direction to Cedar City.

**The Louisiana Southern** has been ordered by the Louisiana Public Service Commission to reconstruct and rehabiliate two miles of its line which was destroyed in April by a break in the Mississippi river levee near Poydras Junction, La.

**The Louisville & Nashville** will construct a steel bridge 4,595 ft. in length near New Orleans, La., and will build a second track on the Cumberland division from Hiedrick to Pinesville, Ky., a distance of 15 miles, at an estimated cost of $2,000,000.

**The Louisville & Nashville** has awarded a contract to the H. K. Ferguson Company, Cleveland, Ohio, for the construction at Knoxville, Tenn., of a 60 by 600 ft. freight house with a second story at one end for offices, to cost approximately $150,000.

**The Michigan Central,** in conjunction with the Michigan State Highway Commission, will construct a two-span girder bridge, 118 ft. long, over its tracks at Leoni, Mich. The contract for the substructure, including 1,406 cu. yd. of concrete, has been awarded to the Fargo Engineering Company, Jackson, Mich., and the contract for the steel superstructure to the McClintic-Marshall Company, Pittsburgh, Pa.

**The Missouri, Kansas & Texas** has awarded a contract to James Stewart & Company, Chicago, for the construction of a 1,000,000 bu. grain elevator at Glen Parks Yard, Kansas City, Mo.

**The Missouri Pacific** accepted bids until November 27 for the construction of a passenger station at Harrison, Ill.

The Missouri Pacific has awarded a contract to T. S. Leake & Company, Chicago, for the construction at Pueblo, Col., of

a frame engine house 90 by 200 ft. This company has awarded a contract to the Ogle Construction Company, Chicago, for the construction of a 300-ton reinforced concrete coaling station at Bald Knob, Ark.

**The Nashville & Atlantic,** reported in the September issue as applying to the Interstate Commerce Commission for permission to construct an extension from Campaign, Tenn., to Rocky River, a distance of about 12 miles, has completed about four-fifths of the construction, which includes a trestle 336 ft. long and 54 ft. high. The Rocky River Coal & Lumber Company, Nashville, Tenn., is the contractor.

**The National Railways of Mexico** have received government approval of plans and specifications for a proposed new passenger station at Tampico, which it is estimated will cost approximately $500,000. On account of the financial stringency it is probable that the erection of the station will not be started until the early part of next year.

**The New York, New Haven & Hartford** will construct a six track half-through girder bridge over the proposed extension of Capitol avenue, at Hartford, Conn.

**The Pennsylvania** is elevating the tracks of its Atlantic division between Whitman street, Camden, N. J., and a point a quarter of a mile south of White Horse Pike, involving the elimination of two highway grade crossings.

This company has awarded a contract to H. F. Curtis, Philadelphia, for an eastbound gravity hump yard at its West Morrisville, N. J., yards.

This company is asking for bids for the completion of the substructure for the Cherry street undergrade bridge, Erie, Pa., to involve about 600 cu. yds. excavation and 1,200 cu. yds. concrete.

This company has also undertaken improvements and extensions to cost $900,000 at its Enola Yard on its low grade freight line three miles west of Harrisburg, Pa. The work includes the erection of a new steel freight car repair shop, 100 ft. by 620 ft., the building of which has already been begun.

This road has also inquired for bids for all the work necessary to complete the strengthening of the bulkhead of the American Agricultural Chemical Company's warehouse at Baltimore, Canton, Md., to require about 4,300 tons stone, 9,600 sq. ft. concrete floor and 300 cu. yd. back fill and excavation.

This company proposes the installation of extensive waterfront facilities at Little Creek, near Norfolk, Va., where it has purchased about 1,000 acres of land together with water rights. The improvement includes the construction of a modern freight warehouse at St. Julian avenue, Norfolk and at Little Creek, a complete rail-water terminal will be constructed to involve an expenditure of some $3,000,000.

**The San Antonio & Aransas Pass** has awarded a contract to the Virginia Bridge & Iron Company for the construction of a bridge over the Brazos River near Wallis, Texas.

**The Santa Fe & Los Angeles Harbor** (A. T. & S. F.) has been authorized by the Interstate Commerce Commission to construct a new line from a connection with the Redondo branch of the Atchison, Topeka & Santa Fe near El Segundo to Wilmington in Los Angeles County, Cal., 12.54 miles.

**The St. Louis-San Francisco** has awarded a contract to the Roberts & Schaefer Company, Chicago, for a 300-ton concrete coaling station at Fort Smith, Ark. This company will also construct a storeroom at Fort Smith.

**The Southern Pacific** has awarded a contract to the Utah Construction Company, Ogden, Utah, for the construction of a single track, concrete lined tunnel, 1,200 ft. in length, on its Coast division, 155 miles south of San Francisco, Cal. This tunnel is being constructed in connection with the revision of the line to eliminate several curves. This company also contemplates the expenditure of $250,000 in shop buildings and machinery at El Paso, Tex.

**The Staley System of Electrical Railway,** of which W. L. Staley of Grants, N. M., is president, has filed an application with the Interstate Commerce Commission for a certificate authorizing the construction of a railway extending from a point on the boundary line between Arizona and New Mexico in Pima County, Ariz., to a point on the Colorado-Utah line in Dolores County, Colo., making a total of 950 miles with 222 miles of branches.

**The Tennessee Central** intends to replace immediately the machine, blacksmith, tin and woodworking shops at Nashville, Tenn., which were destroyed by fire on October 27, with an estimated loss of $80,000.

**The Texas & Pacific** will construct a 100 ft. turntable and a three stall extension to its roundhouse at El Paso, Tex.

**The Texas & Pacific,** in conjunction with the Missouri Pacific, will construct a reservoir which will provide adequate water supply for the two companies at Texarkana, Ark., at an approximate cost of $150,000.

**The Union Railroad** has awarded a contract to the Roberts and Schaefer Company, Chicago, for a 100-ton, two-track, reinforced concrete, automatic electric coaling and sanding plant for installation at Bessemer, Pa.

**The Virginian** will build a new steel coal pier at Sewall's Point, Norfolk, Va., to cost approximately $3,000,000. This pier is to be 1,073 ft. long, 86 ft. wide and 74½ ft. high and to be completely equipped with modern coal dumping machinery having a capacity of about 6,000 tons an hour.

**The Wenatchee Southern** recently applied to the Interstate Commerce Commission for a certificate authorizing the construction of three lines in Washington extending from Wenatchee to Beverly Junction, 53 miles; Hanford to a point near Kennewick, 29 miles, and from a point 13 miles south of Wenatchee to Orendo, 30 miles.

## Equipment and Supplies

**The Chesapeake & Ohio** is inquiring for 500 tons of steel for bridges.

**The Chicago & North Western** has ordered 40,000 tons of rails from the Illinois Steel Company.

**The Chicago & Western Indiana** has ordered 5,000 tons of rails from the Illinois Steel Company.

**The Grand Trunk of Canada** has placed an order for 25,000 tons of rails with the British Empire Steel Corporation, Sydney, N. S.

**The Illinois Central** is reported to have divided an order for 30,000 tons of rails, of which the Inland Steel Company received 10,000 tons.

**The Kansas City Southern** has ordered 540 tons of structural steel from the Kansas City Structural Steel Company, the material to be used in the extension of the company's shops at Pittsburg, Kan.

**The Louisville & Nashville** is inquiring for 2,000 tons of tank plates.

**The Michigan Central** is inquiring for about 11,000 kegs of spikes.

**The Missouri Pacific** has ordered 118 tons of structural steel from the Virginia Bridge & Iron Company.

**The New York Central** has ordered 600 tons of steel for bridges at various places from the McClintic-Marshall Company and is reported to have divided an order for about 25,000 kegs of bolts and 15,000 kegs of spikes between the Oliver Iron & Steel Company, the United States Steel Corporation, the Inland Steel Company and the Buffalo Bolt Company.

**The Northern Pacific** is reported to have ordered 35,000 tons of rails.

**The San Antonio & Aransas Pass** has ordered 768 tons of structural steel from the Virginia Bridge & Iron Company.

**The Southern** is inquiring for 200 tons of steel for bridges.

**The Southern Pacific** has ordered 43,400 tons of rails from the Tennessee Coal, Iron & Railroad Company and 1,600 tons from the Lorain Steel Company.

**The St. Louis-San Francisco** has ordered 118 tons of structural steel from the American Bridge Company, to be used in strengthening bridges.

**The Virginian Railway** has ordered from the Bethlehem Steel Bridge Corporation 5,700 tons of steel for a coal pier.

# Supply Trade News

## General

**The Gibb Instrument Company, Detroit, Mich.,** manufacturers of electric welding equipment, has moved its plant and offices to Bay City, Mich.

**The Norwalk Iron Works Company,** South Norwalk, Conn., has opened a Chicago office in charge of **L. R. Bremser,** who was associated with the Gardner Governor Company for 13 years.

**Dwight P. Robinson & Company, Inc.,** New York, has started work on the design and construction of an extension to the plant of the American Rolling Mill Company at Ashland, Ky.

**The Carter Bloxonend Flooring Company,** Kansas City, Mo., has received a contract from the Baltimore & Ohio for the installation of 12,000 sq. ft. of Bloxonend flooring in a warehouse at Philadelphia.

**The Chicago Malleable Castings Company,** Chicago, has acquired all rights for the manufacturing and selling of the Little Giant and Hercules bumping posts from the Railway and Traction Supply Company of Chicago.

**The Osgood Company,** Marion, Ohio, has established a district sales office at 50 Church street, New York City, with **M. E. Pullen** in charge. All business formerly handled by M. E. Davis, formerly New York representative, will be handled through the district office.

## Personal

**W. W. Sayers,** a representative of the Link-Belt Company, with headquarters at Chicago, has been promoted to chief engineer of the Philadelphia works and Eastern operations, with headquarters at Philadelphia.

**H. P. Hevenor,** until recently a member of Engel & Hevenor, Inc., where he specialized in track construction, has joined the staff of Dwight P. Robinson & Company, Inc., New York, as consulting engineer.

**R. J. Platt,** sales representative of the **Sellers Manufacturing Company,** with headquarters at Chicago, has been promoted to assistant general sales agent, with office at the same place, succeeding **T. D. Crowley,** resigned.

**D. S. Hutchcraft,** formerly vice-president of the Indiana Air Pump Company, Indianapolis, Ind., has been appointed district manager in charge of the **Chicago Pneumatic Tool Company's** recently established branch office at Tulsa, Okla.

**E. C. Wilson,** formerly connected with the U. S. Light & Heat Corporation and the Vapor Car Heating Company, with offices at Chicago, has been appointed western sales manager for the Ohio Locomotive Crane Company of Bucyrus, Ohio, with offices in the Railway Exchange building, Chicago.

**W. E. Caldwell,** assistant sales manager of the Cleveland Twist Drill Company, Cleveland, Ohio, has been appointed sales manager following the retirement of **E. G. Buckwell,** secretary and sales manager, on November 1. Mr. Buckwell will remain a director of the company. Mr. Caldwell has served in the company's sales department for 21 years.

**Andrew C. Scherer** has been appointed assistant to C. W. Gennet, Jr., in the supervision of the rail and track appliances department of Robert W. Hunt & Co., Chicago. Mr. Scherer graduated from the University of Wisconsin in 1909 and immediately entered the employ of Robert W. Hunt & Co., since which time he has served consecutively as chief inspector at the Monterey (Mexico) Steel Works and at the Lackawanna Steel Company's plant, and in charge of the physical laboratory at Chicago, which position he held at the time of his recent promotion. Mr. Scherer served as a lieutenant in the Ordnance Department of the United States Army during the war.

**William Blake Wood,** president of the Gifford-Wood Company, Hudson, N. Y., died on October 28 at the Albany City Hospital, after a two weeks' illness. Mr. Wood was born in Arlington, Mass., on July 15, 1869, and became a member of the firm of William T. Wood & Co., of Arlington, upon the death of his father, Cyrus, in 1896, and continued as a partner with William E. Wood, and later as a member of the Gifford-Wood Co., when it was incorporated in 1905. He succeeded Malcolm Gifford as president upon the latter's death in 1919.

**T. D. Crowley,** assistant general sales agent of the Sellers Manufacturing Company, Chicago, resigned, effective November 1, to become general sales agent of the **Creepcheck Company,** which has opened general sales offices at 564 Peoples Gas building, Chicago. **J. T. Reagan,** western sales manager for the Creepcheck Company, has been promoted to manager of service, with the same headquarters. Mr. Crowley was born at Clinton, Iowa, on August 18, 1884, and entered railway service in 1901 as a timekeeper in the track department of the Chicago & North Western. He was later assistant foreman and extra gang foreman in the same department and in 1907 was appointed assistant roadmaster on the Wisconsin division, with headquarters at Milwaukee. In 1909 he was appointed superintendent of materials in the general storekeeper's department at Chicago and subsequently was appointed roadmaster, with headquarters at Sparta, Wis. In April, 1914, he was employed by the Madden Company as sales agent and continued with that firm until his appointment as assistant general sales agent of the Sellers Manufacturing Company in November, 1918, the position he held at the time of his recent appointment. **Mr. Reagan** was born on July 13, 1887, at St. Louis, Mo., and entered railway service in the transportation department of the Grand Trunk in 1907. In August, 1914, he entered the sales department of the P. & M. Company, Chicago, and in October, 1920, became associated with the Creepcheck Company as assistant general sales agent, the position he held at the time of his recent promotion.

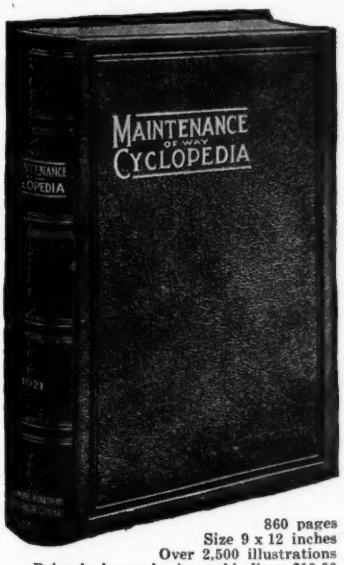
T. D. Crowley

## Trade Publications

**Sand Dryer.**—A coal-burning sand dryer involving what are claimed to be new and improved principles of sand drying is the subject of bulletin No. 48, recently issued by the Roberts & Schaefer Company, Chicago. This bulletin briefly describes the device and includes photographs and line drawing.

**Treated Ties and Timbers.**—A new bulletin has been issued by the Century Wood Preserving Company, Pittsburgh, Pa., on the use of treated ties and timber for industrial uses. This bulletin discusses wood preservation in a general way and devotes particular attention to the discussion of the treatment of "block flooring" and switch ties, and outlines the proper method of piling ties. The bulletin makes a free use of illustrations to show how the treating process is carried on and how timbers should be stored.

**Holt Roof Leader and Vent Connections.**—This 28-page booklet recently issued by the Barrett Company, New York, is descriptive of the eight types of Holt roof connections manufactured by this company. The different types are discussed in relation to their use in flat roof and saw-tooth construction and in places where vent pipes, leader lines, steam stacks, etc., passing through a roof, require flashings. The illustrations show by photographs and drawings actual installations and the way in which they are made.

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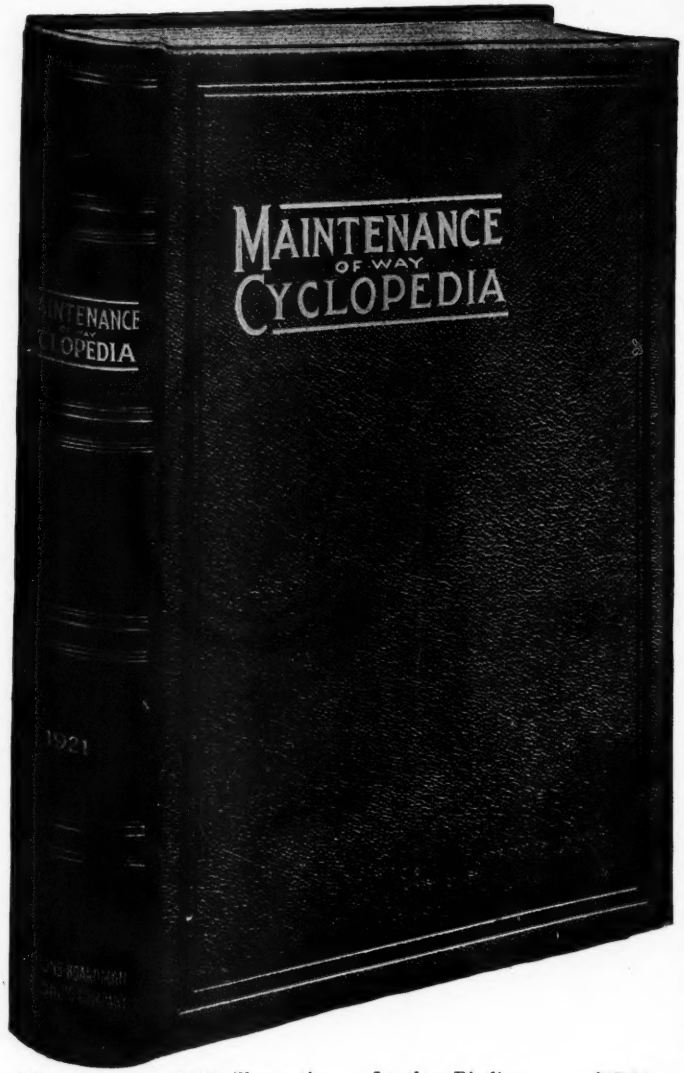


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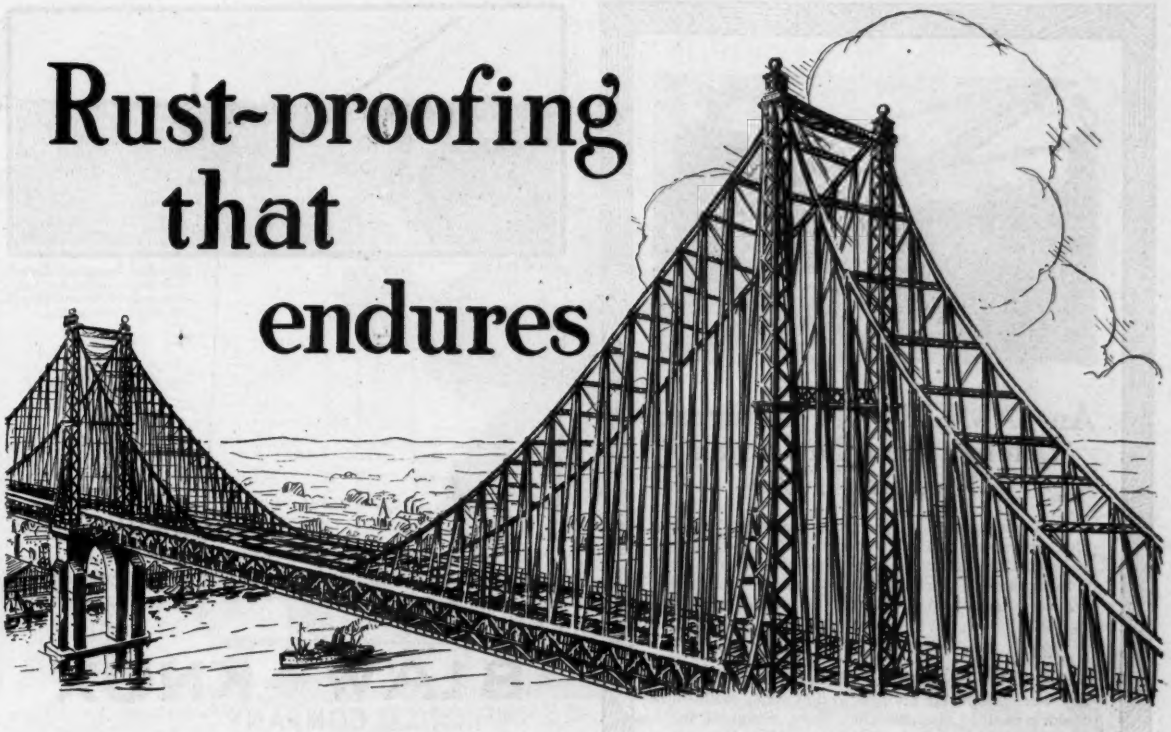

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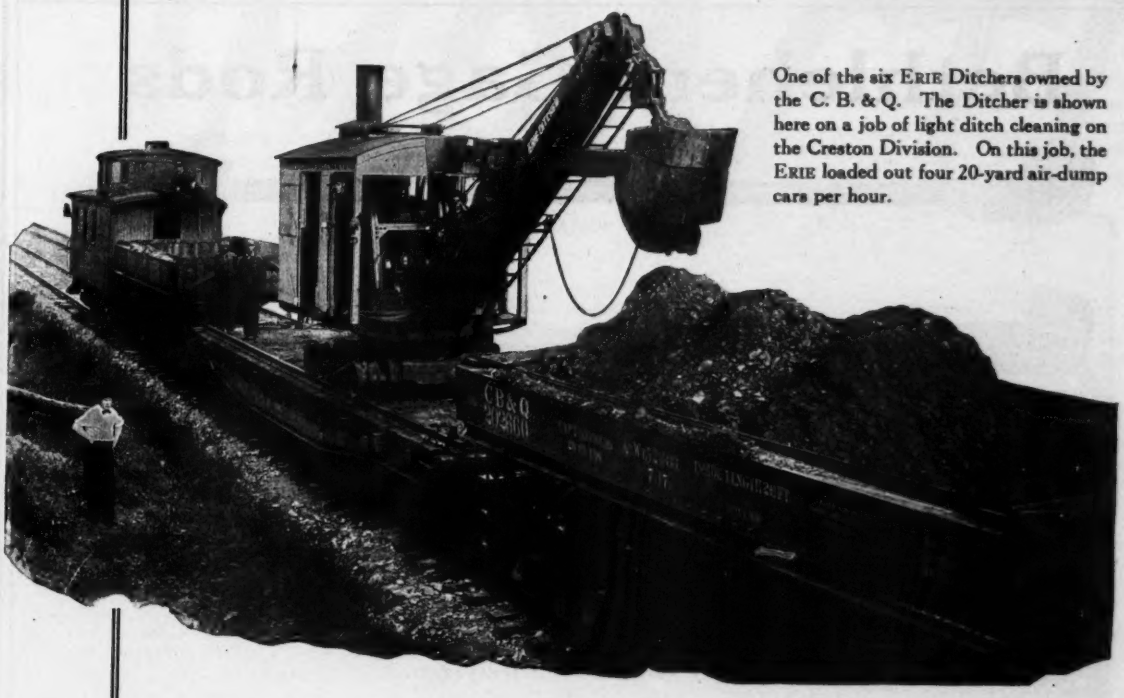

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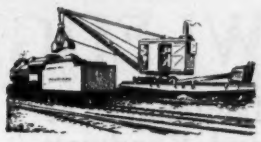

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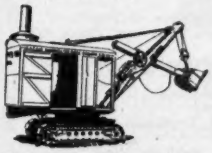

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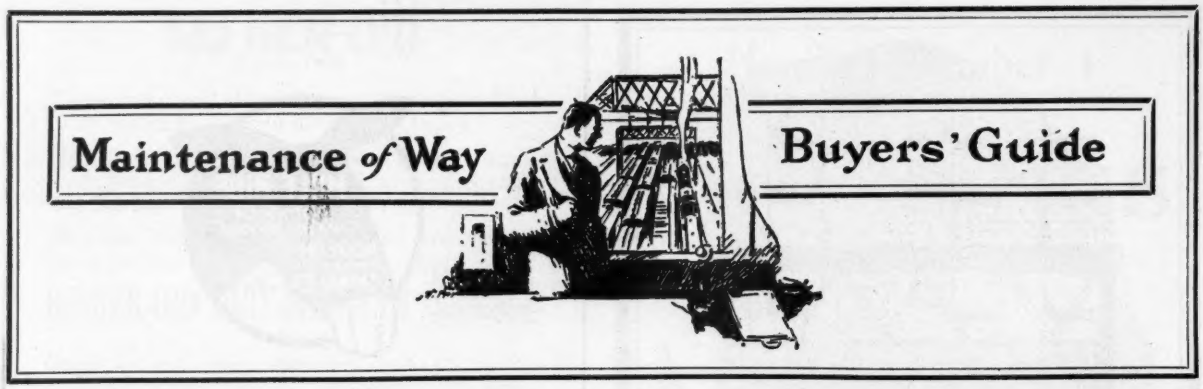


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**Gas, Acetylene.**
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**Gears.**
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**Machinery, Oxy-Acetylene Welding and Cutting.**
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**Out Houses.**
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**Outfit, Rail Bonding.**
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Diamond State Fibre Co.

**Pipe.**
Armco Culvert & Flume Mfrs. Assn.
Massey Concrete Prod. Corp.

**Pipe Carriers.**
Massey Concrete Prod. Corp.

**Pipe Joint Compound.**
Ruberoid Co., The.

**Plants, Welding and Cutting.**
Air Reduction Sales Co.

**Pneumatic Tie Tampers.**
Ingersoll-Rand Co.

**Pneumatic Tools.**
Ingersoll-Rand Co.

**Poles.**
International Creosoting & Construction Co.
Massey Concrete Prod. Corp.

**Powders.**
E. I. du Pont de Nemours & Co.

**Power Houses.**
Massey Concrete Prod. Corp.

**Preservative, Timber.**
International Creosoting & Construction Co.
New Jersey Zinc Co.

**Producers, Gas.**
Air Reduction Sales Co.

**Pumps.**
American Well Works.
Fairbanks, Morse & Co.
Goulds Mfg. Co., The.
Ingersoll-Rand Co.
Sullivan Machinery Co.

**Push Cars.**
Fairbanks, Morse & Co.

**Rails.**
Bethlehem Steel Co.
Inland Steel Company.

**Rail Anchors.**
P. & M. Co., The.

**Rail Anti-Creepers.**
P. & M. Co., The

**Rail Braces.**
Bethlehem Steel Company.
Louisville Frog & Switch Co.
Ramapo Ajax Corp.
Weir Frog Co.

**Rail Joints.**
Bethlehem Steel Co.
Inland Steel Co.
Rail Joint Co.
Wm. Wharton, Jr., & Co.

**Rail Saws.**
Fairbanks, Morse & Co.

**Rare Gases.**
Air Reduction Sales Co.

**Regulators, Oxy-Acetylene.**
Air Reduction Sales Co.

**Riveting Hammers.**
Ingersoll-Rand Co.
Verona Tool Works.

**Rivets.**
Bethlehem Steel Company.

**Rock Drills.**
Ingersoll-Rand Co.
Sullivan Machinery Co.
Verona Tool Works.

**Rods, Welding.**
Air Reduction Sales Co.

**Roof Slabs.**
Massey Concrete Prod. Corp.

**Roofing and Siding.**
Fairbanks, Morse & Co.
Lehon Co., The
Ruberoid Co.

**Screw Spike Drivers.**
Ingersoll-Rand Co.

**Sewer Pipe.**
Massey Concrete Prod. Corp.

**Sewer Pipe Seal Compound.**
Ruberoid Co., The.

**Sheets, Fibre.**
Diamond State Fibre Co.

**Sheet Iron.**
Armco Culvert & Flume Mfrs. Assn.

**Sheet Steel.**
Inland Steel Company.

**Signal Foundations, Concrete.**
Massey Concrete Prod. Corp.

**Slabs, Concrete.**
Massey Concrete Prod. Corp.

**Smoke Stacks.**
Massey Concrete Prod. Corp.

**Spikes.**
Bethlehem Steel Company.
Inland Steel Co.

**Standard Tee Rails.**
Bethlehem Steel Company.
Inland Steel Co.

**Standpipes.**
American Valve & Meter Co.
Fairbanks, Morse & Co.

**Station Houses.**
Massey Concrete Prod. Corp.

**Steam Shovels.**
American Hoist & Derrick Co.
Erie Steam Shovel Co.
Osgood Co., The.

**Steel Forms.**
Blaw-Knox Co.

**Steel Plates and Shapes.**
Bethlehem Steel Company.

**Step Joints.**
Rail Joint Co.

**Street Railway Special Work.**
Bethlehem Steel Company.

**Structural Steel.**
Bethlehem Steel Company.
Inland Steel Company.

**Switches.**
Bethlehem Steel Company.
Frog, Switch & Mfg. Co.
Ramapo Ajax Corp.
Weir Frog Co.
Wm. Wharton, Jr., & Co.

**Switch Locks.**
American Valve & Meter Co.

**Switchmen's Houses.**
Massey Concrete Prod. Corp.

**Switchstands and Fixtures.**
American Valve & Meter Co.
Bethlehem Steel Company.
Fairbanks, Morse & Co.
Ramapo Ajax Corp.
Weir Frog Co.
Wm. Wharton, Jr., & Co.

**Tampers.**
Ingersoll-Rand Co.

**Tanks.**
Fairbanks, Morse & Co.

**Tank Valves.**
American Valve & Meter Co.

**Telegraph Poles.**
International Creosoting & Construction Co.
Massey Concrete Prod. Corp.

**Telephone Booths.**
Massey Concrete Prod. Corp.

**Ties.**
International Creosoting & Construction Co.

**Tie Plates.**
Bethlehem Steel Company.
Inland Steel Company.
Lundie Engineering Corp.

**Tie Rods.**
Bethlehem Steel Company.

**Tin Plate.**
Bethlehem Steel Company.

**Tongue Switches.**
Bethlehem Steel Company.

**Tool Steel.**
Bethlehem Steel Company.

**Tools, Oxy-Acetylene Welding and Cutting.**
Air Reduction Sales Co.

**Torches, Oxy-Acetylene Welding and Cutting.**
Air Reduction Sales Co.

**Track Drills.**
Ingersoll-Rand Co.

**Track Insulation.**
Diamond State Fibre Co.

**Track Jacks.**
Verona Tool Works.

**Track Material.**
Inland Steel Company.
Ramapo Ajax Corp.
Weir Frog Co.

**Track Scales.**
Fairbanks, Morse & Co.

**Track Tools.**
Fairbanks, Morse & Co.
Verona Tool Works.
Warren Tool & Forge Co.

**Trestle Slabs.**
Massey Concrete Prod. Corp.

**Vacuum Pumps.**
Ingersoll-Rand Co.

**Varnish, Electrical Insulating.**
Ruberoid Co., The.

**Washers.**
Diamond State Fibre Co.

**Water Column.**
American Valve & Meter Co.

**Waterproofing.**
Ruberoid Co., The.

**Welding, Oxy-Acetylene.**
Air Reduction Sales Co.

**Weed Killer.**
Chipman Chemical Engineering Co., Inc.
Reade Mfg. Co.

**Wheels (Hand and Motor Car).**
Fairmont Gas Engine & Ry. Motor Car Co.
Woolery Machine Co.

**Wire.**
Armco Culvert & Flume Mfrs. Assn.

**Wire Rope.**
Fairbanks, Morse & Co.

**Wood Preservative.**
Chipman Chemical Engineering Co., Inc.
International Creosoting & Construction Co.
Reade Mfg. Co.

**Zinc Chloride.**
New Jersey Zinc Co.